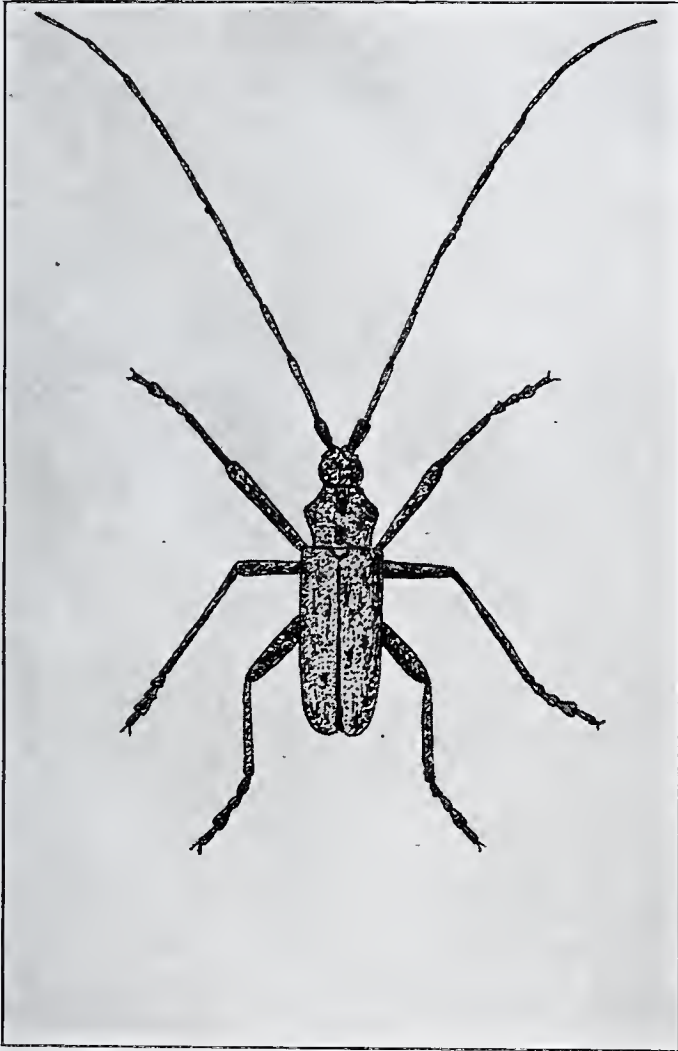



# MANUAL *of* FOREST INSECTS

By H. B. PEIRSON



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# CONTENTS

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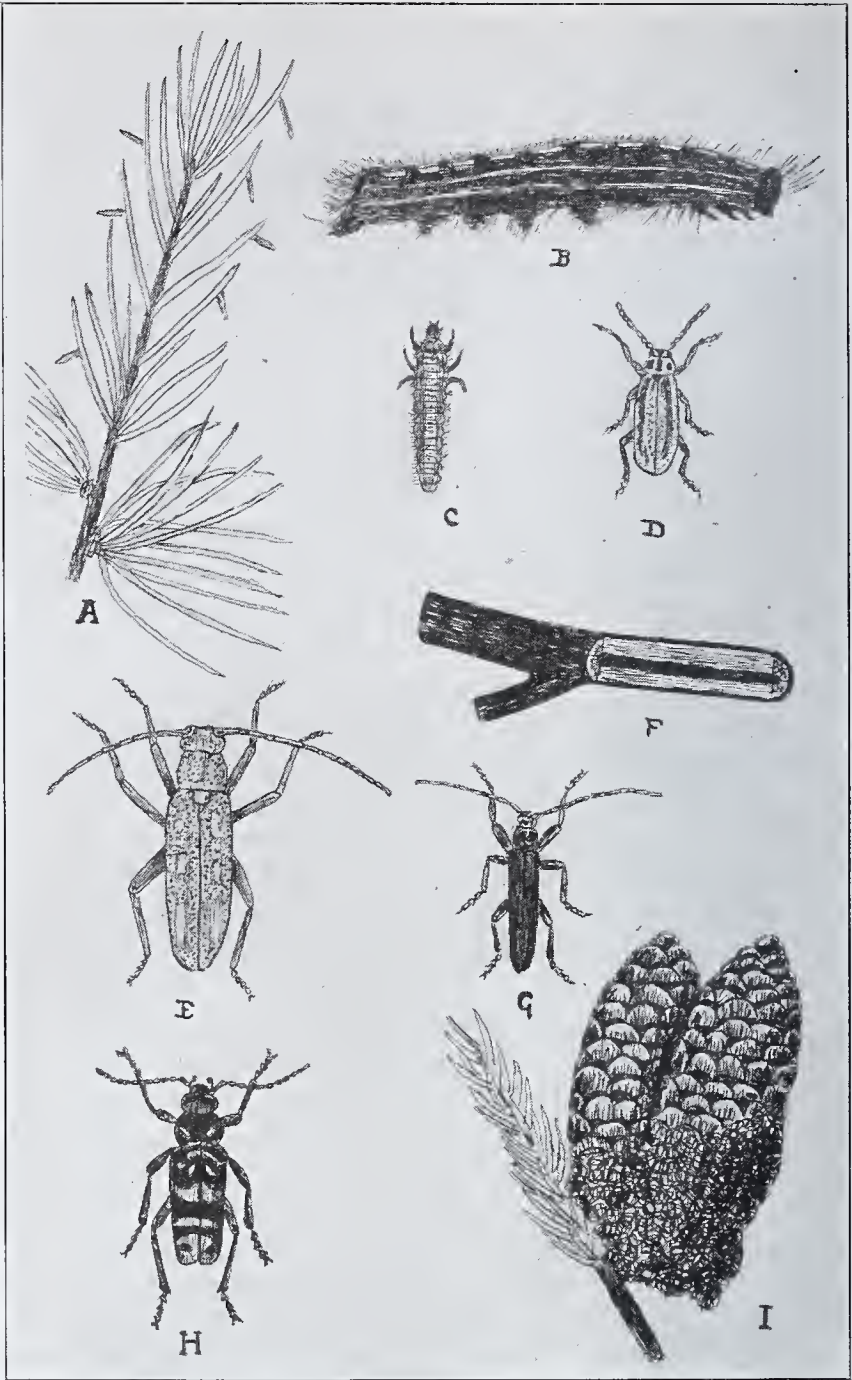
A. Introduction .....	5
B. The tree and how it grows .....	7
C. How a tree may be killed .....	9
I. Fungi .....	9
II. Bacteria and parasitic plants .....	9
III. Physiological:—winter injury, sun scald, root competi- tion, shade, drying out, change of water level, smoke, gases, chemicals, smothering of roots .....	10
IV. Animals:—deer, porcupine, mice, birds .....	12
V. Mites .....	12
VI. Insects .....	13
D. Why insects are increasing in numbers .....	15
E. How insect outbreaks start .....	16
F. Why insect outbreaks die out .....	17
G. Insects attacking forest trees .....	21
I. How to recognize and report an outbreak .....	22
II. Host trees and their enemies .....	22
a. Insects attacking alder .....	22
b.     "         "         arbor vitae .....	25
c.     "         "         ash .....	27
d.     "         "         basswood .....	32
e.     "         "         beech .....	36
f.     "         "         birch .....	38
g.     "         "         butternut .....	45
h.     "         "         cherry .....	48
i.     "         "         chestnut .....	52
j.     "         "         elm .....	53
k.     "         "         fir .....	59
l.     "         "         hemlock .....	68
m.     "         "         hickory .....	71
n.     "         "         larch .....	73
o.     "         "         locust .....	80
p.     "         "         maple .....	82
q.     "         "         oak .....	89
r.     "         "         pine .....	95
s.     "         "         poplar .....	111
t.     "         "         spruce .....	116
u.     "         "         willow .....	123
H. Principal forest trees covered by this bulletin .....	125
I. Index .....	127



# Introduction

The object in publishing this Manual of Forest Insects is primarily to bring together for the use of those interested in forest preservation a general survey of the insects destructive to forest trees in New England. The descriptions of the insects and their work have been made as non-technical as possible. The methods of control must of necessity be very simple and in the majority of cases still consist in cutting the infested area, much as a surgeon removes infected tissue. When detailed studies have been made of an insect, methods of forest management have usually been found that will largely prevent injury. The literature of forest entomology has been freely referred to and listed for further reference by the reader who may wish more detailed accounts. Control of the insects under shade tree conditions is also given some attention.

The knowledge of forest insects and their control is of particular value to those desiring to buy forest lands, to those desiring to protect their forest lands from destruction, and to those who wish to formulate plans of management that will lessen the danger from insect attack. The wholesale destruction of forests by insect attack such as has repeatedly taken place in Maine is just as unnecessary as the destruction of forest growth by fire, and the time will come when this useless waste will be stopped. A German forest entomologist was recently asked what was done in Germany to stop large bark beetle outbreaks. His reply was "they discharge the forester." In other words they never allow a bark beetle outbreak to become of epidemic size. The future here will see our forests patrolled and watched for possible insect outbreaks just as they are today for fires. In a like manner efforts will be made to stamp out possible epidemics in their infancy just as today we hasten to put out a fire before it becomes a conflagration.



A. Larch Case Bearer showing cases on needles ( $\frac{2}{3}$  natural size). B. Forest Tent Caterpillar. C. Larva Elm Leaf Beetle (enlarged twice). D. Elm Leaf Beetle (enlarged twice). E. Adult Poplar Borer. F. Work of Oak Twig Pruner. Twig split to show burrow and severed end ( $\frac{1}{2}$  natural size). G. Adult Oak Twig Pruner. H. Adult Sugar Maple Borer. I. Work of Spruce Cone Worm.



# The Tree

In order to better understand the effects of insect attack on trees it is well to briefly review some of the paramount facts relating to tree growth. Recent studies are tending to make even more striking the definite relationship which exists between plant and animal life. The growth of a tree, like the growth of an animal, depends largely upon its ability to respire and to properly absorb food. We find that trees have a fairly complicated circulatory system, a digestive system, and there are indications of activities analogous to those of a nervous system. Trees respond to light, temperature, and chemical stimuli. Interference with any of these factors has its effect on tree growth and may bring about the death of a tree.

The yearly growth of a tree can be likened to the placing of one hollow cone over another. Elongation starts at the tips of the branches and is followed by lateral expansion which extends over the limbs and trunks to the tips of the roots. Water and soluble chemicals are taken in by the fine root hairs and carried up thru the sapwood to the leaves. The air supplies carbon which is absorbed as carbon dioxide thru the stomata or respiratory pores found principally on the under side of leaves, and to some extent on other parts of the tree. Here it is manufactured into the necessary nutriment for the tree. This food is then carried down thru the inner bark or phloem and absorbed by the cambium, which is the active growing part of the tree. During the growing season the cells in the cambium are constantly enlarging and dividing. As the season advances the new cells being formed become smaller. This gives the darker appearance to the outer edge of the ring which is known as the summer wood. This forms a basis for determining the yearly growth of a tree. Under exceptional conditions two apparent rings may be formed in a single year due to early defoliation and consequent slowing up in growth, followed later in the season by a refoliation and the consequent resuming of growth. In some cases, as shown by Bailey, an apparent additional ring may be formed by frost injury. In cases of severe defoliation the amount of food formed may be insufficient to form a ring completely around the tree or to form

any ring at the base of the tree. The importance then of the foliage, the cambium layer, and the roots to the life of the tree is very apparent.

A cross section of a tree shows in the center the heartwood which is inactive and gives strength to the tree. Then comes the sapwood through which the upward flow of sap takes place and, according to some authorities, a slight transverse flow and even a slight downward flow. Next comes the cambium which is the moist outer layer of cells between the so-called bark and sapwood. Here the lateral growth of the tree takes place, the new cells adding to the wood and at the same time pushing out the bark, causing it to crack and flake off. Next to the cambium comes the phloem which consists of several layers of cells known as the sieve tubes thru which the downward flow of sap takes place. These are associated with layers of storage cells. Next to the phloem comes the cortex or green bark which contains living tissue for food storage and food elaboration. In this living tissue a cork cambium usually appears which forms the outer bark. If it were not for this bark a tree would soon dry out and die. Lenticels or openings occurring on the bark allow for the exchange of gases between the underlying cells and the outside air.



# How a Tree May Be Killed

The agencies which may bring about the death of a tree are fully as numerous as those which may attack a human being and are often fully as hard to diagnose. It is the purpose of this paper to deal only with one group of these enemies, namely the insects, but in order to recognize their work, it is necessary to understand something of the work of other enemies and these will be briefly reviewed.

## FUNGI

Second only to insects as enemies of trees come the large number of fungus diseases which attack all parts of the tree. Fungi are a low form of plant life which depend entirely upon food which has been manufactured by other living matter. They are called parasitic when subsisting on living matter and saprophytic when living on dead matter. The parasitic fungi destroy tissue by absorbing and living on the plant food which ordinarily keeps the host alive and by destroying the living protoplasm itself. The effects of the fungi may simply retard growth or may kill the tree.

The most common diseases are found on the foliage and are known as leaf spots or blights. Many of these diseases pass the winter on the fallen foliage. The following season spores are discharged which reinfect the new foliage. Other diseases such as the chestnut blight and the white pine blister rust live in the cambium and wood tissue of the tree sending their hyphae or branches between and into the cells, preventing the downward flow of sap, and absorbing food which otherwise goes to keep up the life of the tree.

Among the most destructive fungi are those causing the heart-rots, root rots, and sap stains. These are largely of the general type of bracket fungi, and toadstools, of which the so-called shoe string root rot is typical, and gain a foothold on the tree thru wounds.

## BACTERIA AND PARASITIC PLANTS

Bacteria are responsible for some leaf blights and a few galls found on stems. Burls and witches brooms are caused by

small parasitic plants. One specie of mistletoe occurs in eastern United States which causes the witches brooms on spruce. It is particularly common on black spruce. Trees are frequently killed or dwarfed by this plant. The mistletoe plant seeds in the fall. Under forest management spruce seed trees should be chosen which are not affected by the mistletoe.

## PHYSIOLOGICAL

This term covers the many causes of tree injury not included under insects, fungi, or bacteria, such as adverse climatic, soil and air conditions.

**1. Winter injury.** During the season of 1924, many reports were received of dying pine which proved to be the results of severe winter injury. It is thought that death from cold is in reality due principally to drying out. During extreme low temperatures, water is withdrawn from the cell walls and cell-sap and forms in crystals. The protoplasm may become so dry that life cannot be maintained. The cell contents become concentrated due to the withdrawal of water much as is the case during severe drought. Low temperatures accompanied by dry winds often result in exceptionally severe injury, especially to trees on exposed hillsides, and in stands, largely to the exposed tops of dominant trees. Trees or portions of them may be killed outright in the winter or in some cases the injury may not show up until spring, or early summer, after the new foliage has come out. The first symptom is usually a yellowing of the foliage or in the case of pine, short needles of a reddish tinge. The bark soon becomes infested with bark beetles and later cracks off. An icy coating on trees does not cause winter killing.

**2. Sun Scald.** This injury usually shows up as loosened bark on the south and southwest sides of trunks and branches. The north side of a tree is not affected. The cause is similar to that found in winter killing, but is due more to the sudden rising and lowering of temperature within the tree brought about by sunlight. This greatly increases the possibility of freezing and brings about quick precipitation of ice within the cells by a principle known as supercooling. It has been found

that white-washing the trunks of young trees will prevent this injury as the white-wash reflects the sun's rays, preventing the tree from absorbing the heat.

**3. Root competition.** In dense stands many trees and much of the reproduction dies from the lack of nourishment. The competition amongst the roots for food is so great that only the more vigorous trees survive.

**4. Lack of sunlight.** Some trees are very intolerant of shade and when out-topped by other trees may succumb. This is particularly true of many of the broad leaved trees which require considerable sunlight, such as poplar and birch. The dying of the lower branches of conifers is usually due to shade, the needles ceasing to function when the sunlight is shut off from them.

**5. Drying out.** Following heavy thinnings in the forest many of the remaining trees, particularly the conifers, die as the result of the drying out of the soil. Roots which in the normal forest lived in moist humus and soil, soon dry out due to the effects of wind and sunlight. Not taking into consideration prevailing winds, it has been claimed that reproduction on the west and south edges of cuttings is more prevalent in that it does not receive so much of the direct drying rays of sunlight which, away from the borders of the cutting and on the east and north sides, kills many of the one-year seedlings.

**6. Change of water level.** The draining or flowing of lakes and bogs often destroys the trees on the borders due in one case to the drowning and consequent smothering of the roots and in the other case to the drying out of the roots. The extreme delicate nature of the feeding rootlets makes them very susceptible to changes.

**7. Dust.** Trees frequently die from smothering brought about by the coating and plugging up of the stomata on the leaves by dust, smoke, or poisonous gases. Such injury is common in the vicinity of stone crushers and mills using sulphur or chlorine. Conifers may be killed in a single season.

**8. Chemicals.** The roots of trees are often killed by chemicals or oils which either prevent moisture reaching them or kill them direct. Gas escaping from mains will kill trees.

**9. Smothering of roots.** The raising of the soil level to any appreciable extent will prevent oxygen from reaching the roots, thus smothering them, and eventually killing the tree. In places where the ground level is to be raised, it is advisable to fill in as much as possible with stone, so that air can penetrate to the roots.

## ANIMALS

Several species of animals feed to some extent on forest trees. It is reported that when the larch was killed by the sawfly about 1880 the caribou migrated out of the State due to the destruction of one of their principal foods. Deer and moose feed to some extent on the tips of young trees. Red pine in some sections seems to be immune to this damage. Porcupines feed on the bark of many species of trees. Mice at times girdle trees at the base. Beaver feed on poplar and yellow birch and destroy some areas by flooding. Sap suckers at times kill trees by the many punctures they make thru the bark of trees such as birch, beech, hemlock, and poplar. The damage done by the above listed animals seems insignificant and to some extent is offset by the good that they do.

## MITES

These minute creatures seldom more than three one-hundredths of an inch in length do some damage to trees. The adult usually has four pairs of legs and lives largely by sucking the juice of plants. In most cases there are many generations a year, each one taking about ten days. They are particularly troublesome during dry seasons. Some feed on the juice of leaves causing them to turn color prematurely, others form galls such as those found on white ash. In this case the staminate flowers on the male trees are infected by a species of mite which causes them to persist on the trees as black distorted clusters thru the winter.



## INSECTS

Insects are omnipresent. There is hardly a thing made or grown which is not attacked to some extent by them. We find minute snow fleas feeding in enormous numbers on plant spores, so plentiful at times along winter tote roads that the crust is blackened by them. We find fly larvae living in tanks of crude oil, beetles boring in lead cables, maggots feeding in living flesh, ants tunneling thru the ground. We find insects on the highest mountains (reported at 21,000 feet on Mt. Everest) and in the seas, within the Arctic Circle and in hot springs. We find them spreading disease, making large areas on the surface of the earth uninhabitable. Each year it is estimated that twenty per cent. of man's food is sacrificed to insects. The annual loss from insects in the United States is estimated at over two billion dollars. Theodore Roosevelt has said "the worst animal foes of man, indeed the only dangerous foes, are insects." There is no question but that they are playing an important role in determining the course of the human race, many well informed men believing that they may eventually even dominate man by destroying his food and forests.

It is impossible in this paper to describe the countless forms of insects. Over 600,000 different species have already been described, many times the number of all other known species of plants and animals combined. In general, the body of the adult insect is divided into a series of segments which are grouped into three regions—head, thorax, and abdomen. The principal structures found on the head are the antennae which contain sense organs, for touch, and in some cases for hearing, and smell; two types of eyes, and the mouth parts. The latter are of two types—chewing and sucking. The thorax bears the three pairs of legs and two pairs of wings or modifications thereof. The abdomen bears the ovipositor and sting. Covering the insect is a horny skeleton. The insect breathes thru minute spiracles or openings found along the sides of the thorax and abdomen. The life of an insect consists usually of four stages egg, larva, pupa, and adult. The larva may be like the adult, as in grasshoppers, or entirely different as in moths. The adult may live only a single day as is the case of

mayflies, or for many years as is the case with certain queen ants. Larvae of beetles have been known to live for ten or more years, but the average length of this stage is only a few months. The following table lists the forms dealt with in this bulletin.

Order	Adult	Larval Form	Economic Importance
Orthoptera	Walking sticks Roaches	Same as adult	Leaf feeders Camp pests
Isoptera	White ants	Same as adult	Wood feeder
Coleoptera	Beetles Weevils	Grubs Borers	Feed on all parts of plants
Hemiptera	True bugs	Same as adult	Leaf feeders
Homoptera	Cicadas Plant lice Scale insects	Same as adult	Leaf, twig, and root feeders. Sucking insects
Lepidoptera	Moths Butterflies	Caterpillars	Leaf feeders and wood borers
Diptera	Flies	Maggots	Leaf miners, Wood borers, Gall makers,
Hymenoptera	Sawflies	Hairless cater- pillars	Leaf feeders Parasites Wood borers



# Why Insects Are Increasing

The question is often asked, "Are insects increasing in number?" There is unmistakable evidence that they are and that man is confronted with a grave danger in his fight against these hosts of injurious insects. In the first place insects are prolific breeders, an individual female moth often laying hundreds of eggs in a single season. A queen ant may produce hundreds of thousands of eggs during her lifetime. In the case of aphids or plant lice there are many generations a year, so that each female may be the stem mother of multitudinous progeny. In the case of some insects a single egg may give rise to many individuals, even as high as twenty-five hundred. It is interesting to note that all individuals arising from a single egg are of the same sex. Insects show a remarkable power of adaptation to changing conditions. Where most life would be destroyed by the countless enemies that insects have, we find them evolving protective coverings and colorings and recently one specie has even been found to be gaining an immunity to the spray which hitherto has been used to destroy it.

A second factor which is tending to increase the numbers of our injurious insects is specialization in agriculture. White pine which at one time seldom occurred in pure stands of any size, now occurs in large bodies throughout central New England. This means that what was at one time a mixed forest crop has now become a specialized crop. Large areas of pure poplar and white birch have seeded in on burns. Methods of cutting and insect attack are increasing the amount of pure stands of fir. Cutting operations are leaving vast areas of slash. Even our forest planting program has tended to increase the areas of pure stands. Insects which at one time had only individual trees of the same species scattered here and there thru the forest to feed upon, now find large areas of the same species to satisfy their greed. This fact alone accounts for the great increase of many forest insects. No one factor so influences the rise and fall in abundance of an insect pest as the food supply.

A third factor influencing the increase of insect pests is transportation. Under normal conditions insects are held in abeyance by their enemies, but when transported into new fields they find themselves unopposed, and rapidly increase in numbers. Examples of this are to be found in the San Jose scale, Gipsy Moth, and larch sawfly. Insects are distributed by man, animals, birds, wind, and water.

## How Insect Outbreaks Start

Forest insect outbreaks usually start up in areas of pure growth and with favorable conditions spread over wide areas. A mixed forest growth is partially immunized against attack. Factors favoring an insect outbreak are (1) a pre-period in which the insect is at low ebb so that its parasites are also greatly decreased in number, (2) an abundance of the insect's favorite food, and (3) favorable weather conditions, such as deficiency of rainfall and relatively high temperatures. It has been suggested that the smoke from forest fires drives out the birds from the forest that might otherwise keep certain insects in check.

# Why Insect Outbreaks Die Out

There are several factors which may cause an insect outbreak to die out, any one of which may be the primary cause in an individual case, and it is unsafe to give particular weight to any one factor. It does seem very questionable tho that either parasites or birds are ever in themselves responsible for stopping an insect outbreak.

**1. Lack of food.** The lack of food is often a deciding factor in weakening or stopping an outbreak. In the recent series of spruce budworm outbreaks, it has been quite evident that lack of suitable food stopped the outbreaks. In this case fir is the principal food and at the present time it is almost impossible to find a pure stand of this species in the northern part of the State, consequently the outbreaks have largely died out.

**2. Climatic conditions.** Climatic conditions often play a very important part in curbing insect outbreaks. An early spring very often brings out insects which later may be killed by frosts. This is particularly true in those cases where the winter is spent as larvae. Heavy rains at times stop defoliators by washing them off. Rainy seasons increase the amount of sap in trees which has a tendency to drown wood borers. Work by Craighead on the relation between bark beetle outbreaks and precipitation admirably brings out this point.

**3. Artificial control.** Man is beginning to take a very active part in the fight against insects and the control and prevention of forest insect outbreaks is at last becoming a reality. The field is still new and each year brings forth new possibilities as research brings out the fundamental facts upon which all work of standing must be based. Prevention of outbreaks must be based largely upon good forest management. This may take several forms such as forest sanitation, short rotation for those species of trees which are particularly susceptible to insect attack, and an effort to keep the forest

stocked as mixed growth. Control in the forest must take the form of destruction or salvage of the infected host or the destruction of the insect itself. These methods will be discussed in connection with the individual insects. Under certain conditions where the trees have more than their mere pulpwood or lumber value chemical means of control may be employed.

Although dusting from airplanes is still in somewhat of an experimental stage, this means of controlling insect pests is being resorted to more and more. The airplane has been used successfully in combatting the cotton boll weevil, cranberry insects, mosquitoes, orchard pests, and in several cases forest insects. In Europe, this means of controlling forest insect outbreaks has been resorted to for some years. A serious outbreak of the Nun Moth was successfully stopped in Bavaria by dusting the forest from an airplane with arsenate of lead, using it at the rate of about thirty-two pounds to the acre.

In Wisconsin a bad outbreak of the Hemlock Spanworm over an area of about seven hundred and fifty acres was very satisfactorily controlled by airplane dusting. Arsenate of lead was used at the rate of twenty pounds per acre. Forty-eight hours after the application was made the ground was covered with dead caterpillars that had been killed by the poison.

There is little question but that outbreaks of the spruce budworm and other forest defoliators will in the future often be controlled in this way. The cost of stopping outbreaks by airplane dusting will depend largely upon locating the outbreak before it becomes widespread. On small areas a contract has been let to dust the forest at a rate of four dollars per acre, and as time goes on this cost will undoubtedly be lessened. Even at this rate the cost is small when we consider the possibilities of saving vast areas from destruction. The airplane has also been successfully used in locating forest insect outbreaks.

**4. Birds.** Birds play an extremely important role in holding in check incipient insect outbreaks. It is unfortunate that there are not more insectivorous birds in the forest. Their scarcity is particularly noticeable in the north woods. Amongst the more common birds are the thrushes, several of



the wood-peckers, Pine Siskin, Canada Jay, chickadee, and the yellow-bellied Sapsucker. The latter bird is particularly interesting owing to its habit of girdling trees with rings of small punctures. As the sap exudes, swarms of insects come to feed upon it and the sapsucker returns to feed on the insects thus attracted. It is true also that the sapsucker feeds upon the sap itself, at times even becoming intoxicated on it.

**5. Parasitic and Predaceous Insects.** Parasitic and predaceous insects are nature's natural check and under normal conditions maintain a balance in the forest. These insects are amongst the most interesting ones found in nature. They live entirely by preying upon other insects. The principal parasites belong to the order Hymenoptera and are characterized by their four membranous wings, rather long antennae, and usually the presence of an ovipositor. Certain species are particularly common during the summer months around logs and dying trees. Their general habit is to light on the infested log or tree and walk around with the antennae rapidly vibrating. The vibrations caused by the chewing of the borers apparently travel thru the galleries and are picked up by the antennae of the parasite which then begins to drive its ovipositor thru the bark and wood into the gallery left by the borer. In the case of the long-tailed *Thalessa*, the ovipositor is often over four inches long and this is driven thru the wood of maple into the burrows of its host. The egg passing down thru the ovipositor is deposited in the burrow, and upon hatching, the larva follows down the burrow and attacks and kills the borer. In the case of many parasites the eggs are laid directly in the host, whether it be in the egg, larval, or adult stage. The control of the gipsy and brown-tail moth by the importation of their natural parasites has been one of the outstanding entomological achievements of the age. In the case of native forest insects man can at present do very little to increase their parasitic enemies.

Certain other insects, notably some of the beetles, are known as predaceous feeders. These live largely by feeding on other insects. Examples of this type of insect are to be found in the *Coccinellidae*, commonly known as Lady Beetles or Lady Bugs. In general, with many exceptions, those that are black with

red or yellow spots feed on scale insects, whereas those that are red or yellow with black spots feed on plant lice or aphids. Many of the so-called tiger and ground beetles, which are very active, feed largely on other insects.

**6. Disease.** Insects, like man, are subject to disease and in many cases man has utilized this weapon in combatting such pests as the gipsy moth, grasshoppers, and mound building ants. Both fungus and bacterial diseases are known. The greatest success comes in combatting those insects which are gregarious in their habits, such as those living in nests. The disease may be grown on media such as boiled rice or potato agar and this spread broadcast where the insects will feed on it, and start the spread of the disease.



# Insects Attacking Forest Trees

## HOW TO RECOGNIZE AN OUTBREAK

Forest insect outbreaks are very much like fires in that they almost invariably start up in small isolated areas of pure growth and then under favorable conditions assume epidemic form and spread over vast areas. Insects in endemic form may be found at practically all times throughout the forest so that the presence of a notably dangerous insect in small numbers may under certain conditions be perfectly safe. The amount of available food can usually be taken as a fairly safe criterion as to the danger of an outbreak.

In watching for outbreaks there are certain points which are often overlooked. In the first place something of the life history and habits of the insect must be known. A report may come in that a defoliating insect is working on a piece of timber. Later at the time of examination the insect may be in the egg stage, so that to the casual examiner the area may appear free from insects and a report made on this examination would be worse than useless. A second mistake that is often made is the reporting of secondary insects for primary ones. This is particularly true in the case of many bark beetles and wood borers which attack only dead or dying trees. In areas where insect outbreaks are suspected, but are not visible from the ground, individual dominant trees should be cut and examined for egg masses, hibernating larvae, pupal cases, and bark beetles or borers. An examination of the ring growth will show much as to the general health of a stand. Series of narrow rings indicate weakness, but if followed by wider rings indicate recovery. This is usually an important point to determine particularly in softwoods after defoliation, or during bark beetle outbreaks. The lack of so-called "red top" trees is no indication that the growth is healthy. It is true that the foliage on fir trees turns red when the trees are dying, but the needles on a spruce may remain green after the tree has died, or ceased to put on any growth. The presence of red tops is, however, a distinct sign of unhealthy conditions.

## HOW TO REPORT AN OUTBREAK

In reporting an insect outbreak, it is always desirable to collect and send in specimens of both the insects and the work which they are doing. Larvae and caterpillars can be put in a small vial of salt and water and this packed in cotton or loose paper. Notes accompanying specimens should state the location of the outbreak, names of trees or parts thereof being attacked, general seriousness of the outbreak, and length of time insects have been working. This information is very essential in making up recommendations for control, as it very often happens that two or more insects with entirely different life histories may do the same type of damage.

## HOST TREES AND THEIR ENEMIES

The following list of trees is arranged alphabetically with the principal insects attacking them listed as leaf feeders and wood borers according to their prominence. In cases where an insect has several host trees it will be described under its principal host and listed as "Other Insect Enemies" under its secondary hosts. When listed under the head "other insect enemies" the page on which it is described may be found by referring to the index unless it is unimportant, in which case no description is given. Wherever possible, control measures will be given for both forest and shade tree conditions.

## INSECTS ATTACKING ALDER

This tree or shrub is very common throughout Maine, but is of little use except as a source of high grade charcoal.

### **Alder Blight Aphid**

*Prociphilus tessellatus*

This insect is particularly conspicuous during the early summer as white cottony masses on the underside of the twigs, stems, and branches of alder. It is of particular interest due to its alternate host. The winter is spent as eggs which are laid in cracks or under the loose bark of soft maples. The so-called stem mothers after hatching from the winter eggs feed for a short time on the mid-rib on the under side of the new leaflets at which time they are known as the wooly maple aphid. During the latter part of June and the first of July

they fly to the alders where the young are deposited by these stem mothers on the under side of the leaves. After feeding for a short time they migrate to the twigs, branches, and stems. It is at this time that they assume the cottony appearance due to the white waxy substance which they secrete. This undoubtedly acts as a protection to the delicate aphids against rain and to some extent against predaceous insects. The caterpillar of the little orange butterfly, *Feniseca tarquinius* commonly known as the Harvester or Wanderer is, however, quite often found feeding on these aphids. During September and October migrants fly back to the trunks of maples where the winter eggs are laid. A few pass the winter on the alder. This insect is commonly and erroneously referred to by woodsmen as the "Spawn of the black fly."

Aphids are extremely frail and are easily destroyed by washing off with a forcible spray of water.

(Pergande, Theo. U. S. D. A. Bur. of Ent., Tech. Ser. No. 24;—1912).

### Alder Flea Beetle

*Haltica bimarginata*

The larvae or grubs of this beetle often skeletonize the alders over large areas during July and August. The adult beetle is steel blue in color with greenish reflections on the head. It is oval shaped and about one-quarter inch in length. The beetles emerge in the spring when the leaves are well out. The yellow eggs are laid in clusters on the leaves. These hatch in a few days and the rather sluggish grubs soon begin skeletonizing the foliage. The grubs are black headed and brown bodied with black tubercles. The larval stage lasts about twenty-five days. In the early fall the grubs pupate in the leaf mold beneath the alders and in about two weeks the adults appear. These feed for a time on the remaining leaves and then hibernate for the winter.

On ornamental alders the insects can be controlled by spraying with arsenate of lead. Under forest conditions cutting and burning of infested alders in July is apparently the only feasible method of control.

(Woods W. C., Maine Agr. Exp. Sta. Bul. 265, Pp. 249-284;—1917).

**Alder Weevil***Attelabus rhois*

This insect is of little economic importance, but attracts some attention on account of its peculiar habits. The adult is one-fifth of an inch long, dull reddish, covered with yellow pubescence. About the middle of June it eats a slit near the base of the leaf on each side of the mid rib and at right angles to it. One or two eggs are laid on the leaf near the mid rib. The leaf is then folded together and rolled up thimble-shape with the ends neatly tucked in. Before beginning to roll up the leaf, the stem is nearly gnawed off so that the rolled up leaf is easily blown off by the wind.

(Packard, A. S., Fifth Rept., U. S. Ent. Comm. P. 632;—1890)

**Alder Leaf Roller***Gelechia oronella*

Packard considered this insect the most striking of the various alder leaf rollers. The caterpillar causing the injury is an amber-colored worm with rather long hairs at end of body. The leaves are partially rolled up and sewed with a white silky substance. The larva feeds within this roll. The damage is particularly noticeable during August and September. The small light gray moths fly in May.

(Packard, A. S. Fifth Rept., U. S. Ent. Comm. P. 630;—1890)

**Alder Gall Borer***Saperda obliqua*

Alders are frequently girdled by the larvae of *Saperda obliqua*. The beetle is about three-fourths of an inch long with rather long antennae, and resembles a withered leaflet. It is reddish-brown with dark brown oblique depressed bands on the wing covers. The beetles are found in June. They lay their eggs close to the ground in the stems. These eggs hatch into small white larvae which mine first beneath the bark and later into the wood, usually forming a straight upward tunnel. The insect causes irregular gall-like swellings at the base of the stems, causing them to die and break off. The stems are frequently completely girdled. Control would consist of cutting and burning infested shoots in the fall.



### Other Insect Enemies

*Phyllonoryter auronitens*—A leaf miner causing rounded flattened mines on underside of leaves.

*Tetrops canescens*—Bores in stems of alder.

*Telphusa belangerella*—A minute leaf roller.

*Dolba hyloeus*—Leaf feeder. Larva of a sphinx moth.

*Cimbex americana*—Leaf feeder. A large white larva.  
See insects attacking elm.

*Gelechia coryliella*—Larva feeds within sterile catkins.

*Nematus Spp.*—Leaf feeders. Several species of sawflies.

*Geometrid Spp.*—Leaf feeders. Several species of measuring worm.

*Trypophloeus nitidus*—A minute bark beetle. Reported from Nova Scotia.

### INSECTS ATTACKING ARBOR VITAE

This tree, commonly called white cedar, or simply cedar, occurs throughout the State, but attains its greatest size in the central and northern part where it forms stands of considerable area. The tree is particularly valuable for railroad ties, poles, and shingles. The tree is comparatively free from insect enemies.

#### Arbor Vitae Leaf Miner

*Argyresthia thuella*

The damage caused by this insect has been quite pronounced in some sections of the State during 1924-1926. The injury shows up as grayish and brownish tips. Upon being dissected the small scale-like leaves will be found to have been hollowed out. The injury is particularly noticeable on hedges and around openings such as cuttings and pastures. The minute whitish moths are to be found flying in June. The life history of the insect is not very well known. The moths lay their eggs in mid-summer on the edges of the leaves. Upon hatching, the young larvae mine in the leaves of the preceding year's growth, becoming full grown near the end of the season. The larvae are of a yellowish color with the head slightly darker. Control measures have not been fully worked out as yet, altho Dr. Britton of Connecticut obtained favorable results with a contact insecticide.

**Bag Worm***Thyridopteryx ephemeraeformis*

Altho this insect is not as yet reported in Maine it occurs as far north as New York and Massachusetts. It is known to feed on the foliage of twenty-three different plants of which Arbor Vitae is particularly favored. In June the young larva begins the construction of a bag which is made out of particles of bark, pieces of leaves, etc. fastened together with silk. This case or bag which serves as a protection to the larva is carried in an upright position first, but later, as it becomes heavy, it hangs down. The bag is carried about wherever the larva goes, and when disturbed, the larva quickly retreats into the bag. Early in September the larva seeks a favorable position and secures the bag from the upper end by a silk band. The pupal stage lasts but a few weeks. The male moths are black with beautiful feathery antennae. Their wing expanse is about one inch. The female moth is grub-like and wingless. She never leaves the protecting bag. The eggs are deposited in a mass of dark brown wooly material. Several hundred to three thousand eggs have been counted to a mass. The winter is passed in the egg stage within the bag. The injury is due to defoliation. Occasionally twigs have been found strangled by silk threads (Houser). Ornamentals can be protected by spraying early in June with arsenate of lead at the rate of four pounds to one hundred gallons of water or by hand picking the bags. Under forest conditions cutting and burning of the slash are the only apparent possibilities of control at the present time.

(Houser, J. S., Bul. 332, Ohio Agr. Exp. Sta., Pp. 215-218;—1918)

**Other Insect Enemies**

- |                               |                                                                                                                                                |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Recurvaria thujaella</i>   | A leaf miner which at times is quite prevalent. The moth is creamy white dusted with black. The dull reddish larvae feed in May in the sprays. |
| <i>Monoctenus juniperinus</i> | Arbor Vitae Sawfly—defoliator reported from Connecticut.                                                                                       |
| <i>Lachnus thujaefalinus</i>  | A hairy amber-brown aphid with the upper surface partly covered with white powder. Feeds in clusters on the bark and branches.                 |



*Phloeosinus canadensis* A small black bark beetle. Very common in dying tops and branches. Also attacks weakened and living trees. At times of considerable economic importance.

*Phloeosinus dentatus* A bark beetle.

## INSECTS ATTACKING ASH

Three species of ash occur in Maine—the white, black, and red. Of these, the white ash is the most common and is of considerable economic importance in the State. Owing to the fact that the tree usually occurs in mixture with other hardwoods, the insect enemies have not proved a menace.

### Fall Canker Worm

*Alsophila pometaria*

This insect is at times a severe defoliator working largely in the tops of trees. The wingless female moths lay their eggs for the most part in the fall on the branches of the trees. These eggs, which are laid in clusters, appear like miniature flower pots and hatch about the time the leaf buds open. The caterpillars, which are of the type commonly known as “loopers” or “measuring worms,” are black with three narrow white stripes and a broader lemon yellow stripe on each side. They feed for about a month, then go into the ground, where they spin a cocoon and pupate, emerging as moths in November or some time the following spring.

(Herrick, G. W., *Injurious Insects*, P. 107;—1925)

(Porter, B. A., & Alden, C. H., *The Cankerworms*, U. S. D. A. Dept. Bul. No. 1238;—1924)

### Fall Web Worm

*Hyphantria cunea*

The larvae of this insect feed on over one hundred different food plants, of which ash is recorded by Lutz as a particularly favorite host. The moths, which vary considerably in color from a pure white to white spotted with black, appear in July and lay their clusters of yellowish eggs on the underside of the leaves. The moths found in northern New England are usually pure white. The eggs hatch in about ten days. The young larvae are pale yellow with a black head and two rows of black

spots along the body. Later the body assumes a greenish tinge, with a dark stripe along the back, yellow stripes along the sides, and covered with light colored hairs springing from warts. As the larvae feed they spin a silken web of light texture which later in the season becomes not only of great size, but very unsightly, owing to the castings and brown remains of foliage. When full grown the larvae pupate in the ground where the winter is spent. At times this insect becomes a serious defoliator in the southern range of ash.

In the case of shade trees webs should be stripped off as soon as they appear. Small infested branches may be pruned and the nests burned. Spraying with arsenate of lead on the foliage around the nest will prevent the spread of the larvae. One and one-half pounds of the powder should be used for fifty gallons of water.

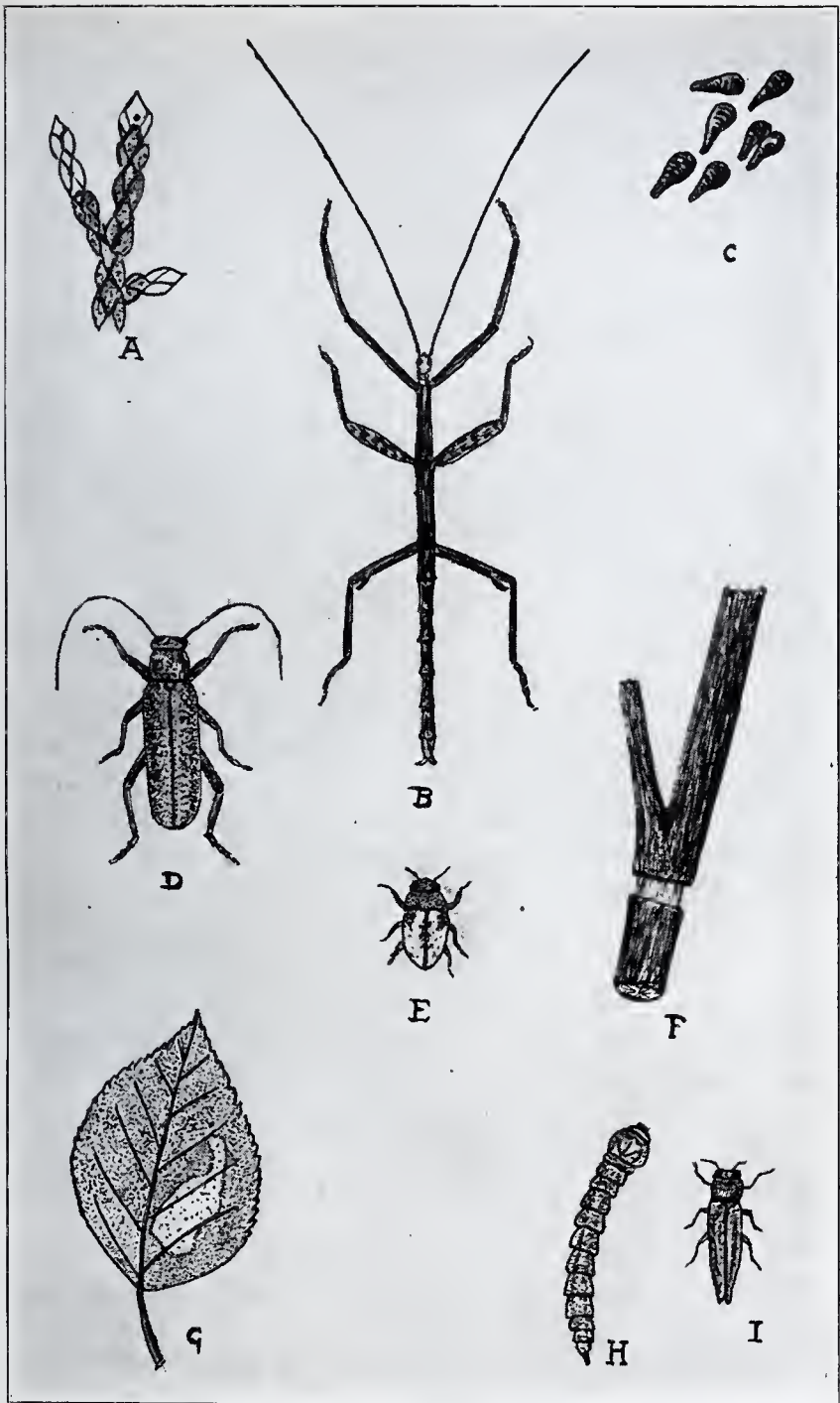
(Lutz, F. E. Field Book of Insects, P. 168;—1918)

(Packard, A. S., Fifth Rept., U. S. Ent. Comm., Pp. 244-248;—1890)

### Oyster Shell Scale

*Lepidosaphes ulmi*

Houser reports a heavy infestation of this scale in which hundreds of large ash trees were killed in northern Ohio wood lots. In New England young forest trees at times become severely infested with this insect and mature white ash has been killed in Maine. The oyster shell scale is a native of Europe which has become quite generally distributed in this county. To quote from Fernald—"During the winter, examination of the scale will show beneath it at the narrow end, the dead body of the insect, and behind it from fifteen to one hundred tiny whitish eggs. These hatch the following May or June, according to the advancement of the season, into very small whitish nymphs or "crawling young," which are extremely delicate and with no scale. These young crawl out from beneath the parent scale and wander about for a few hours or even a day or so, seeking for places where they may settle; then each thrusts its beak through the bark and begins feeding, and degeneration of eyes, antennae and limbs, and the secretion of wax over the body beings. To this secretion the molted skin is added at each molt, making a very tough, hard, covering scale. The insect beneath this becomes adult after a time and following the laying of its eggs, dies. In the northern States the eggs are laid in August or September."



A. Work of Arbor Vitae Leaf Miner. B. Walking Stick. C. Oyster Shell Scale. D. Adult Linden Borer. E. Linden Leaf Beetle. F. Work of Oak Twig Girdler. G. Work of Birch Leaf Skeletonizer. H. Bronze Birch Borer (larva). I. Bronze Birch Borer (adult).

Under forest conditions judicial cutting and salvaging of infested trees in the winter will prevent an outbreak from assuming epidemic form. Shade trees may be sprayed in the winter with a lime sulphur wash.

(Houser, J. S. Bul. 332, Ohio Agr. Exp. Sta., P. 175;—1918)

(Fernald, H. T., Applied Entomology, Pp. 209-210;—1921)

### Round-headed Ash Borer

*Tylonotus bimaculatus*

The adult of this borer is an elongated, slender, dark brown beetle about five-eighths of an inch long, sparsely covered with short light yellowish hairs. The beetle attacks living trees, often killing them. The larvae mine beneath the bark first in the larger branches and later as the trees become weakened, in the trunk.

### Banded Ash Borer

*Neoclytus capreae*

The banded ash borer is reported as attacking black ash in particular, and is recorded as having done considerable damage to forests of this species. This beetle is approximately one-half inch long, of a dark purple color with narrow yellow lines on the thorax and three cross bands of yellow on the wing covers. The larvae mine for a short time beneath the bark and then enter the sapwood which they honeycomb. They feed to some extent on the outer heartwood. The mines are tightly packed with granular frass. There is but one generation a year. This insect is particularly abundant in dying trees. Control would consist of salvaging infested trees.

(Felt, E. P., Mem. N.Y. State Mus., No. 8, Vol. 1, Pp. 279-280;—1905)

### Four-marked Ash Borer

*Eburia quadrigeminata*

The adult beetle is about three-fourths inch long, of a light brown color, bearing at the base and about the middle of each wing cover, pairs of ivory-like elevations. The brown antennae are longer than the body. The larvae bore largely in dead ash. Packard reports a case of breeding this insect from an ash sill which had been laid twenty years before. This is apparently an interesting case of longevity due to lack of moisture.

(Packard, A. S., Fifth Rept. U. S. Ent. Comm. Pp. 541-542;—1890)



**Ash Flower Gall***Eriophyes fraxiniflora*

The staminate flowers of the white ash are often attacked by mites which cause the flowers to become distorted into black clusters which persist on the trees throughout the winter. Although this injury is of little economic importance it attracts considerable attention.

For ornamental trees a winter application of a miscible oil is reported effective in preventing the unsightly condition caused by the mites.

**Other Insect Enemies**

- |                                |                                                                                                                                              |
|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Malacosoma disstria</i>     | Forest tent caterpillar. This a very common forest defoliator that, in spite of its name, does not spin a tent. See insects attacking birch. |
| <i>Porthetria dispar</i>       | Gipsy moth. See insects attacking oak.                                                                                                       |
| <i>Hemerocampa leucostigma</i> | White marked tussock moth. A defoliator. See insects attacking elm.                                                                          |
| <i>Automeris io</i>            | Io moth. The larvae are pale green and are covered with black poisonous spines. Not common. See insects attacking cherry.                    |
| <i>Ceratomia undulosa</i>      | Sphinx moth. Larvae are leaf feeders.                                                                                                        |
| <i>Phyllophaga spp.</i>        | May or June beetles. Feed on foliage.                                                                                                        |
| <i>Prionoxystus robiniae</i>   | Carpenter worm—makes large galleries sometimes over one inch in diameter in heartwood.                                                       |
| <i>Parandra brunnea</i>        | Parandra borer, completely honeycombs wood.                                                                                                  |
| <i>Molorchus bimaculatus</i>   | Round headed borer. Breeds in dead ash.                                                                                                      |
| <i>Bellamira scalaris</i>      | Chestnut brown to black beetle. Found in dead ash.                                                                                           |
| <i>Leperisinus aculeatus</i>   | Ash timber beetle. A bark beetle very common in the limbs and trunks of dying trees.                                                         |

## INSECTS ATTACKING BASSWOOD

This tree occurs scatteringly through the forest in lowlands where the soil is rich. Owing to the fact that the tree is not found in pure stands its insect enemies are relatively few in number.

**Basswood Leaf Roller***Pantographa limata*

This insect attracts attention due to its unusual feeding habits. The black headed pale green larva cuts a slit more than half way across the middle of the leaf. The cut end is then rolled into a tube the ends of which are turned in and within which the larva feeds. These tubes or cones are particularly abundant in September. When full grown the larva leaves its nest and forms a smaller and more simple one which is merely a fold of one edge of the leaf. This new nest is lined with silk forming a cocoon within which the winter is spent, the leaves falling to the ground. Pupation takes place the following July and the adult moths appear in August. These have a wing expanse of a little over one inch. The wings are straw-colored with a purplish iridescence and are covered with elaborate olive colored markings.

(Comstock, J. H., Introduction to Entomology, Pp. 646-647;—1924)

**Lime Tree Winter Moth***Erannis tiliaria*

A serious outbreak of this Geometrid, a measuring worm, is reported as having occurred in Vermont in 1924-25 by Bailey. The moths appear in October and November. The males are of a yellowish orange color, while the females, which are wingless, are black and white.

The larva is yellow with ten fine black lines running lengthwise on its back. The head is red. A large number of hardwood species are attacked by this insect.

Banding the trees in the fall with tanglefoot or spraying in the spring with arsenate of lead are recommended as means of control in the case of shade or ornamental trees.

(Bailey, L. H., Vt. Dept. of Agri., Bul. No. 35, P. 22;—1926)



**Linden Leaf Beetle***Chrysomela scalaris*

The foliage of linden is often injured by both the grub and adult stage of this insect. The small oval-shaped beetles are particularly noticeable due to their markings. The head and thorax are dark coppery green. The wing covers are silvery white with somewhat mottled dark coppery green markings. The dark markings form a central band with prolongations going out towards the middle of the wing covers. The outer half of the wing is dotted with the green markings. The yellowish oval eggs are laid in the spring on the new leaves. The plump whitish grubs have a row of both dorsal and lateral spots on the body. These grubs feed on the foliage, causing it to turn yellow and fall prematurely. The insect probably pupates in the earth, and in July and August the adults emerge and feed to some extent on the foliage, chewing round holes in it.

Spraying with arsenate of lead is the most feasible means of control.

(Packard, A. S., Fifth Rept. U. S. Ent. Comm., Pp. 479-480;—1890)

**Walking Stick***Diapheromera femorata*

From a purely physical standpoint this is probably the most interesting insect seen in our northeastern forests. It is well named, the body being long and tubular, with very long thin legs and antennae, giving the insect the appearance of a branched twig. Its power of mimicking the twigs of the plant on which it feeds has been developed to a high degree. Altho this insect feeds on a large number of hardwood species, basswood is recorded as its favorite host. Small groves are at times completely defoliated.

The small, highly polished, bean-like eggs which are slightly over one-eighth of an inch in length are laid promiscuously on the ground in the fall. These eggs are black in color with mottled lighter markings and remain throughout the winter. Some of them hatch in the spring, others hatch throughout the season and many remain unhatched until the second season. The young, upon hatching, are similar in shape to the adult. They are spectre-like, of a pale yellow color and keep close to the ground. Their habit of immediately dropping to the

ground when disturbed, protects them from observation. They change very little from birth to maturity except as to color and size. The color follows very closely that of the foliage, changing from the light green of the newly opening buds in the spring to the dark gray-brown of the foliage in the fall. The males are slightly smaller than the females.

Spraying or dusting the trees with arsenate of lead will destroy the insects. It is also claimed that light ground fires will destroy the eggs, but this is a dangerous procedure except under very favorable conditions.

(Packard, A. S., Fifth Rept. U. S. Ent. Comm., Pp. 317-321;—1890)

### Leaf Mining Linden Beetle

*Chalepus rubra*

This beetle is about one-quarter of an inch long, flat, broadly wedge-shaped. In color it is pale reddish yellow to rose-red with pale darker markings along the sides of the wings. There are also three raised ridges on each wing. The life history has not been thoroughly worked out, but is probably very similar to that of the locust leaf miner, which lays its shingle-like eggs in small patches on the underside of the leaves. The larvae upon hatching enter into the leaf tissue mining it out and causing the leaves to turn brown.

### Linden Borer

*Saperda vestita*

This is a serious enemy of considerable economic importance. The adult beetle is approximately one inch long, black, covered with a dense olivaceous pubescence usually with three denuded spots near the middle of each wing cover. The beetle is robust, with long antennae. In August the beetles emerge and feed on the leaf petioles, larger veins on underside of leaves, and the green bark of growing shoots, often killing the tips of branches. The female beetle deposits her eggs in small punctures on the trunk and branches made by chewing into the bark. A female may lay as many as ninety eggs. The larvae undermine the bark and often penetrate the wood. On young linden trees the injury usually occurs on the trunk within a foot of the ground.

The beetles may be destroyed by spraying the underside of

the foliage with arsenate of lead. Under forest conditions infested trees should be cut in the winter and removed from the forest or burned.

(Felt, E. P. and Joutel, L. H., N. Y. State Mus. Bul. 74, Pp. 54-58;—1904)

### Twig Girdler

*Oncideres cingulata*

This interesting beetle is approximately one-half of an inch long, of a smoky reddish brown to clay yellow color with a light broad band across the elytra or wing covers. The female lays her eggs in the twigs and then chews a girdle around the twig below the eggs. The twig dies, and is broken off by the wind. It is in these fallen twigs that the larvae mature. The adults are particularly abundant in August and September.

Control comes in burning or destroying the fallen twigs in the fall or early spring.

(Parrott, P. J., Kan. Agr. Exp. Sta. Bul., 77, Pp. 56-62;—1898)

### Broad Necked Prionus

*Prionus laticollis*

The adult is one of the largest native beetles we have, being approximately one and one-half inches long and five-eighths of an inch in width. The color varies from a very dark brown to a jet black. The mandibles are very strong and conspicuous with very sharp cutting edges. The antennae are stout and about one-half as long as the body. The thick fleshy grubs, which when full grown are about three inches long, feed on the roots of linden and other trees. They are particularly injurious to young trees. It takes three years for the insect to mature.

### Other Insect Enemies

*Ceratomia amyntor*—Four-lined Sphinx. This is a stout pale green and reddish brown larva. It has a conspicuous caudal horn and four large tubercle-like elevations on the thoracic segments. It is about three inches long when full grown and occurs in September.

*Cimbex americana*—Elm sawfly—defoliator. See insects attacking elm.

- Thyridopteryx ephemeraeformis*—Bagworm-defoliator. See insects attacking Arbor Vitae.
- Malacosoma disstria*—Forest tent caterpillar. Defoliator. See insects attacking birch.
- Hemerocampa leucostigma*—White marked tussock moth. See insects attacking elm.
- Lithocolletis lucetiella*—Leaf miner attacking under side of foliage.
- Lithocolletis tilieacella*—Leaf miner making circular tent mines on upper side of leaf.
- Cecidomyia verrucicola*—Linden wart gall—forming sub-globular galls on both sides of leaf.
- Eriophyes abnormis*—Linden mite gall—Top-shaped galls on upper surface of leaves
- Lepidosaphes ulmi*—Oyster shell scale. See insects attacking ash.
- Parandra brunnea*—Parandra borer.
- Hylurgopinus rufipes*—Small bark beetle. Also attacks elm.

## INSECTS ATTACKING BEECH

The American beech is destined to come a very important timber tree in Maine. It is particularly abundant on moist rocky soils through the central part of the State. Although there are many insects that feed on beech, it apparently has few serious insect enemies in this State.

### Beech Span Worm

*Hyperetis nyssaria*

The larvae of this insect belong to that family commonly known as measuring or inch worms. They feed during the early fall on the foliage of the beech. The head is small and somewhat flattened. The general color of the body is lilac brown with a pair of whitish spots on the back of each segment. The cocoon is formed by bringing together leaves. The adult moth is pale whitish with fine cross specks on the fore wings.

### Felted Beech Scale

*Cryptococcus fagi*

Timber cruisers are reporting very serious and somewhat widespread injury to beech in Nova Scotia from this insect



pest. At times it is reported that practically the entire trunk and limbs will be covered by this insect, giving the tree an appearance of being coated with matted cotton. There are reports of its having been found near Halifax as far back as 1911, and it is quite probable that it was there many years before this. Beech in New England should be watched carefully for the appearance of this pest, and infested trees should be immediately cut and burned. It has been the unfortunate history to wait until pests such as this assume wide-spread epidemic form before any efforts are made to destroy them.

The adult female is lemon yellow in color and about one twenty-fifth of an inch in length, hemispherical in shape. She has no power of locomotion, remaining stationary throughout life. The body becomes coated with a waxy filamentous secretion. The young lice are active and can rarely be seen by the naked eye. They, too, soon become coated with the cottony mass. They are distributed by both wind and birds.

(British Forestry Commission, Leaflet No. 15, The Felted Beech Coccus; —1926)

### **Beech Tree Blight Aphis**

*Prociphilus imbricator*

This frail insect is found on the underside of limbs and is protected by a bluish white waxy secretion that appears like cotton. Small limbs and trees are at times killed by this insect.

Under shade tree conditions the trees should be sprayed with either korosene emulsion or nicotine sulphate.

### **Wooly Beech Leaf Aphis**

*Phyllaphis fagi*

It is a very common thing to find the leaves of purple beech coated with wooly aphids. The young aphids are pale greenish yellow in color and may frequently be found nestling among the hairs along the leaf veins. As the aphids grow they secrete a flocculent bluish white secretion which serves to protect them from other insects and from climatic conditions such as heavy rains.

### **Divaricated Buprestis**

*Dicerca divaricata*

During July and August these beetles can be found sunning themselves on the limbs of dying or dead beech trees. The



adults are flat bodied and of a brassy brown color, usually from one-half to three-fourths of an inch long. The elytra or wing covers are thickly covered with small punctures, and numerous impressed lines with many raised smooth places. The elytra are elongated to narrow blunt pointed tips, somewhat divergent. The larvae are of the typical flat-headed type, the fore segments being moderately broad, and the abdominal segments narrower, round, and thick. This insect also attacks cherry and maple, at times becoming very destructive.

### New York Weevil

*Ithycerus noveboracensis*

The New York weevil is a large grayish beetle approximately one-half inch long with a long snout on the end of which are its biting mouth parts. It feeds chiefly on the base of new buds and twigs causing them to break and fall off.

### Other Insect Enemies

*Heterocampa guttivitta*—Antlered maple caterpillar. See insects attacking maple.

*Alsophila pometaria*—Fall cankerworm. Defoliator. See insects attacking ash.

*Halisidota maculata*—Oak Tussock moth. Defoliator.

*Paleacreta vernata*—Spring cankerworm. Defoliator. See insects attacking elm.

*Hyperplatys maculatus*—Small grayish beetle. Bores in dead twigs.

*Ptilinus ruficornis*—Small dark brown beetle about three-sixteenths inch long infests exposed wood.

## INSECTS ATTACKING BIRCH

Four species of birch are found in Maine—the black, gray, yellow, and white or paper. In considering the insects attacking these four species of birch, only the last two named will be emphasized as they are of great economic importance. The white birch grows on moist sites, commonly about lakes and streams and is usually found in mixture with other hardwoods

and conifers. It primarily follows after cultivation and forest fires. The best stands are found through the central part of the State. The yellow birch is very common throughout the northern two-thirds of the State, particularly on the higher lands.

The most important pests of the birch are those of the wood boring class. The defoliating species are also important as they are numerous and retard the growth causing large annual losses.

### Forest Tent Caterpillar

*Malacosoma disstria*

Altho the forest tent caterpillar is a general hardwood feeder, it is particularly injurious to white birch and poplar. Its occurrence in the Maine forests has been periodic and in one large outbreak recently examined it was very evident that parasites were playing an important part in curbing it. Thousands of acres were defoliated in 1922 and 1923. The female moth is of a light buff color with two dark diagonal lines on the forewings. The thorax is cinnamon colored and the abdomen black with a few scattered brown hairs. The male has a wing expanse of about one inch and is of a richer color.

During July and August masses of eggs are laid in ring-like bands usually completely encircling the twigs. These masses contain anywhere from one hundred to four hundred eggs which are held together by a grayish, frothy, glue-like substance. The egg masses are similar to those of the apple tree tent caterpillar, except that the edges of the masses are cut off square instead of sloping. The winter is passed as the larval stage, altho within the egg shell. The embryo develops within the egg until the stage is reached when it is ready to emerge. It remains in this condition through the winter until the first warm weather of the spring. The larvae feed for about six weeks. Feeding is done largely at night. In spite of its name the larvae form no tent. After an area has been stripped hordes of the caterpillars often migrate to other areas. The young caterpillars are nearly black. When full grown they are about two inches in length. The ground color of the body is bluish or black with a sparse clothing of hairs. Two brownish yellow bands on the sides of the body and a series of cream

colored dots along the middle of the body characterizes this insect. The larvae pupate in rather thick yellowish-white cocoons which may be found almost anywhere.

The danger from this insect comes in repeated defoliations which weaken and may finally kill the trees. The future will probably see this insect controlled by dusting from airplanes. Under some conditions an outbreak can be stopped by early cutting.

### **Birch Leaf Skeletonizer**

*Bucculatrix canadensisella*

During the latter part of the summer the white and yellow birches are often skeletonized by a small pale green caterpillar which when full grown is only about one-quarter of an inch long. When disturbed the caterpillar drops from the leaf by a silken thread. The winter is passed in small brownish ribbed cocoons about one-eighth of an inch long. The moths are bright brown. The wings are crossed with silvery white bars and have a wing expanse of three-eighths of an inch.

(Felt, E. P., Mem. N. Y. State Mus., No. 8 Vol. 1, Pp. 315-317;—1905)

### **Banded Purple**

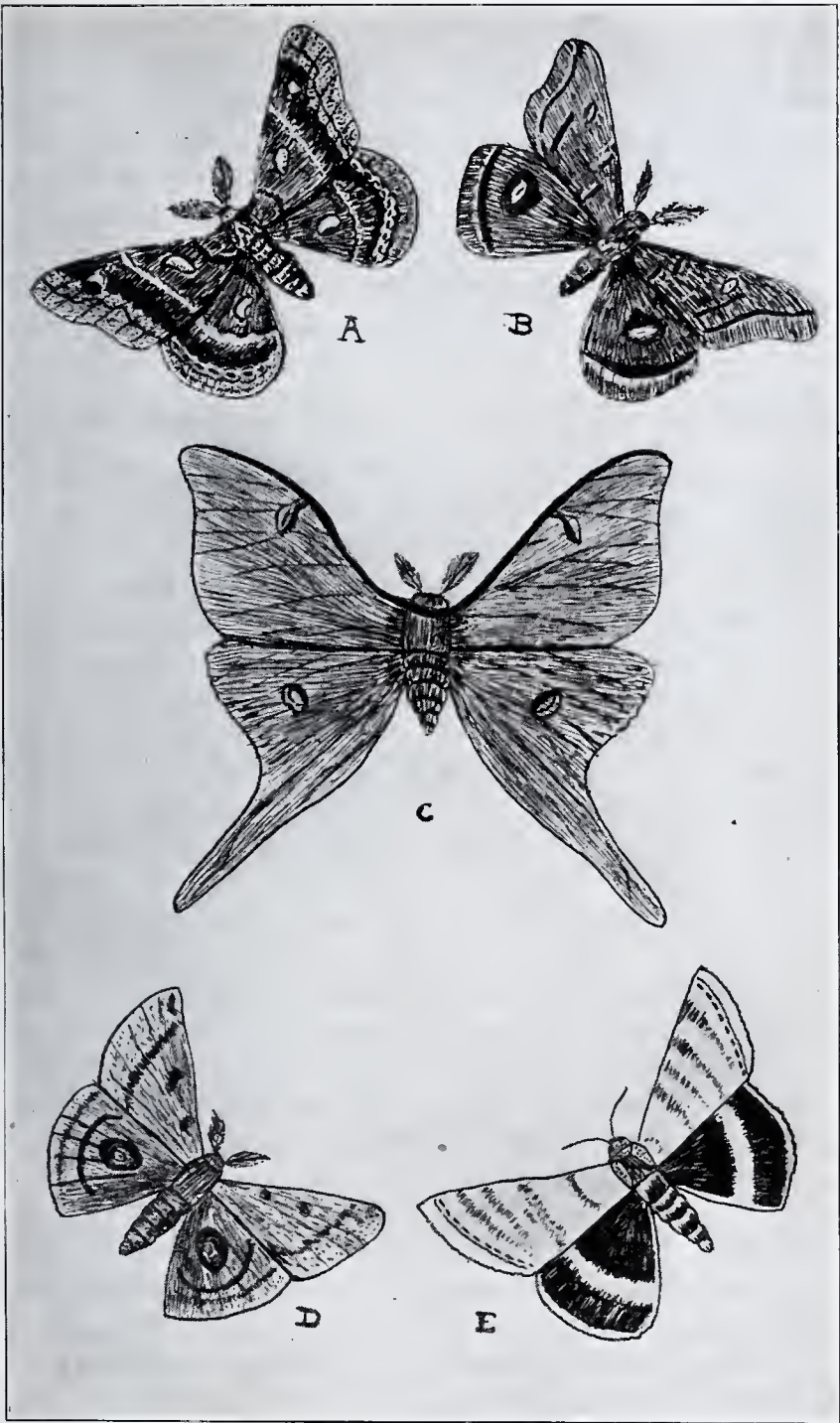
*Basilarchia arthemis*

This insect feeds on the foliage of birch, loosely fastening a small ball of leaf scraps near where it is feeding, apparently to distract its enemies. It also has the peculiar habit of resting along the mid-rib and eating the leaf on both sides, later rolling the uneaten part together. This it lines with silk and fastens to a twig using it as a winter home. The larva is mottled with brown, olivaceous, and cream, with a pale buff saddle. The moth is large, having a spread of wings of about three inches. The ground color of the wings is dark gray with a white band crossing both of them.

### **Luna Moth**

*Tropea luna*

The adult is considered the most beautiful of our New England moths and at times is fairly common. It has a wing expanse of about four and one-half inches. The hind wings are drawn into two long swallow-tail appendages. The color is a beautiful soft pale green. The fore wings have two spots



A. *Cecropia* ( $\frac{1}{2}$  natural size). B. *Polyphemus* ( $\frac{1}{2}$  natural size). C. *Luna* ( $\frac{1}{2}$  natural size). D. *Io* ( $\frac{1}{2}$  natural size). E. *Catocala* ( $\frac{2}{3}$  natural size).



that appear like half moons, and the hind wings two spots that appear like full moons—hence the name ‘luna.’ When full grown the larva is three inches long, stout, pale green and with six rows of small pink tubercles with black hairs springing from them. The cocoon is thin and papery, dropping to the ground in the fall.

Large insects such as these almost never become abundant for they are easily seen by birds and parasites which hold them in check.

### **Polyphemus**

*Telea polyphemus*

The larvae of this insect are extremely large and ferocious looking. When disturbed they have the habit of elevating the fore part of their bodies in a fighting or defensive attitude. The general color is green. The moths are large, the wings being of an ochre color with a slight pinkish tinge. Each wing has a transparent spot, those on the hind wing being bordered inwardly by blue and set in a ring of black.

### **Catocala**

*Catocala relictata*

The moths belonging to this genus are extremely interesting owing to the bark-like protective coloring of their fore wings. The adults of the particular insect in question appear from July to September. The hind wings are dark gray with a white band. The fore wings are grayish white with gray lenticel-like marks. When at rest on a birch trunk with the wings folded, the moth blends with its surroundings. The larvae are greenish-white, thickly spotted with yellowish-brown. The head, ninth and twelfth segments are marked with black. The cocoon which is made of dry fallen leaves on the ground is comparatively thick.

### **Notched Wing Geometrid**

*Ennomos magnarius*

This is the largest of our eastern Geometrids to which the common name ‘measuring worms’ is given. The larvae grow to be more than two inches long, and when full grown spin a dense spindle-shaped cocoon within a cluster of leaves. The moths are found flying in the fall. Their wings are of a reddish yellow color, spotted and shaded with brown. The outer edges of the wings are somewhat jagged in contour.



## Leaf Miners

The foliage of birch is attacked by numerous leaf miners. *Fenusa pumila* is particularly injurious to the terminal leaves of gray birch sprouts and seedlings. *Lithocolletis betulivora* makes small circular mines on the upper side of the leaves. *L. lentella* forms community blotch mines on the upper side of the leaves, several larvae often being found in a single mine. The mined part of the leaf often wrinkles up, causing the leaf to bend in a fold.

## Bronze Birch Borer

*Agilus anxius*

This so-called flat headed beetle is without much question the most serious insect enemy of the birch. Once it infests a tree, that tree almost invariably dies within a few years. The signs of injury are very characteristic. The top of the tree first begins to die, the leaves drying on the small limbs. The branches below are then affected and in a few years the tree is usually dead. This is particularly true of birches growing out in the open.

The slender somewhat flattened bronze colored beetles, which are about one-half inch in length appear early in June and feed for a short while on tender leaves particularly of willow and poplar. The beetles then fly to birch and lay their eggs in the crevices of the bark of small branches of at least one-half inch in diameter. The larvae burrow just beneath the bark zigzagging up and down and cross-wise. It is these numerous diagonal or horizontal burrows that bring about the rapid death of the trees by shutting off the downward flow of sap. The larvae become full grown about the first of October, and at this time enter the sapwood forming cells where the winter is passed. Early in May they transform into the pupal stage and about the first of June the adults appear through semi-circular holes which they cut through the bark.

Studies of this insect have shown that it attacks principally trees growing either in the open or in open stands. Under forest conditions stands of white birch should not be opened up, but rather allowed to mature to the point where it pays to clean cut them. In mixture with other species the plan of management should be such that the white birch is cut at approximately the same time as the other species.

Under shade tree conditions no positive means of control is known other than immediately cutting and burning infested trees. At the present time experiments are being carried on in Maine whereby plant drugs are injected into infested trees in an effort to drive out the borers. Preliminary results give great promise for this means of control.

(Peirson, H. B., Control of the Bronze Birch Borer by Forest Management, Jour. of Forestry, Vol. 25, No. 1, Pp. 68-72;—1927)

(Slingerland, M. V., The Bronze Birch Borer, Cornell Agr. Exp. Sta., Bul. 234;—1906)

### Pith Ray Miners

*Agromyza spp*

Small flies, of the genus *Agromyza*, lay their eggs on the bark, usually in the upper branches of the trees. The young larvae burrow down through the cambium to the base of the trees. This burrow is plugged tight with brown frass leaving long brown-like lines which are known as 'pith ray flecks' or 'medullary flecks.' As the tree grows, these lines are left behind in the wood spoiling it for cabinet or veneer work. In some sections considerable wood is discarded on account of these streaks that otherwise is perfectly sound. It seems very probable that a study of these insects will show that there is a definite relation between the site and densities of stands and the amount of damage. To date this has not been worked out.

### Birch Horntail

*Xyphidria provancheri*

About the first of September this large two winged fly may be seen darting around through stands of white birch. The adult is about five-eighths of an inch long with a wing spread of about one inch. It is jet black in color with light yellow marks, on head, at base of wings, and on several segments of the abdomen. The larva which bores in partly decayed birch, particularly in the heartwood, is yellowish-white in color, with a short dark brown horn at the posterior end. The mouth parts are bordered with black.

### Other Insect Enemies

*Porthetria dispar*—Gipsy moth—defoliator. See insects attacking oak.

*Euproctis chrysorrhoea*—Brown Tail moth—defoliator. See insects attacking oak.

*Nematus unicolor*—Birch sawfly—defoliator.

*Zeuzera pyrina*—Leopard moth—borer. See insects attacking oak.

*Hemerocampa leucostigma*—White marked tussock moth—defoliator. See insects attacking elm.

*Phyllophaga spp.*—May or June beetles—defoliators, larvae root feeders.

*Euceraaphis betulaecolens*—Birch aphid. Often very injurious to ornamentals. Spray with tobacco soap solution.

*Oligotrophus betulae*—Birch-seed gall midge. Causes deformed catkins and greatly swollen seed capsules, on European white birch.

*Cryptorhynchus betulae*—Poplar and willow borer. Snout beetle.

*Ptilinus ruficornis*—Small red-horned borer. Beetles attack exposed wood.

*Bellamira scalaris*—Bores beneath bark of yellow birch.

*Dryocoetes betulae*—Birch bark beetle.

## INSECTS ATTACKING BUTTERNUT

This tree occurs scatteringly in southern Maine on rich moist soils and at times even on rocky hillsides. Its insect enemies are comparatively few and for the most part attack walnut as well.

### Butternut Woolly Worm

*Monophadnus caryae*

These false caterpillars or sawfly larvae have the peculiar habit of secreting a woolly snow white matter from the transverse folds of the body. The larvae feed in masses of sometimes fifteen to twenty on a single leaf and may be completely hidden by the cottony secretion. When full grown the yellowish white larvae are about one-half inch in length. Most of the feeding is done on the underside of terminal portions of the leaves.

**Catocala***Catocala vidua*

Here again we have an interesting case of natural protection in the way of protective coloring. The moths fly in August and September and are about the color of butternut bark. The fore wings, which are on top when the moth is at rest, are gray in color with wavy darker markings. The body of the moth is also gray. The under or hind wings are brownish gray. The larvae are foliage feeders and are pale lilac with stripes composed of black dots, giving a grayish appearance. The head is striped with pale lilac and white, with orange spots above.

**Hickory Horned Devil***Citheronia regalis*

When full grown this is the largest caterpillar which we have. It usually attains a length of over four inches. The long spiny horns on its fore segments give it a ferocious look altho it is not poisonous. The moth has a wing spread of nearly five inches. The fore wings are olive colored spotted with yellow. The wing veins are outlined with reddish scales. The hind wings are orange-red spotted with yellow. There is a distinct olive band near the outer edge. Large insects of this type rarely become abundant, but attract considerable attention when present.

**Virginia Tiger Moth***Spilosoma virginica*

This insect, which in its larval stage is commonly called a wooly or yellow bear, apparently has two generations in Maine. When full grown the larvae are about two inches long. The body and head are of a mottled black and yellow color. Each segment has four tubercles above, which give rise to long yellowish hairs. The moths are snow white with a black dot in the middle of the fore wings and two on the hind wings. There is a row of black dots along each side of the abdomen and another row on top with a deep yellow stripe between. The wings have a spread of about two inches. The larvae feed on a great number of plants. In the fall they form cocoons in sheltered places where the winter is spent.



## Walnut Curculio

*Conotrachelus juglandis*

About the middle of June this snout beetle appears from its earthen pupation cell and deposits its eggs on the husks of the butternuts. The beetle is about one-quarter of an inch long, reddish-brown, ornamented with golden and silvery hairs, with a white band on the posterior third of the wing covers. The larvae are said to mature in about two weeks. Their presence in the nuts is indicated by a discolored spot on the green husk. The feeding of the larvae causes the nuts to drop prematurely. The early destruction of these infested nuts will aid materially in keeping down an infestation the following season. It should be borne in mind that the larvae pupate in the ground and not in the nuts.

(Felt, E. P., Manual of Tree & Shrub Insects, P. 219;—1924)

## Wood borers

A. *Centrodera decolorata* is a slender light brown beetle about one inch long. The stout antennae and feet are darker than the wing covers. The head is dark red with coarsely granulated black eyes. The thorax has stout lateral spines. The larvae bore in butternut and beech.

B. *Cossonus platalea* is a flattened jet black snout beetle about one-quarter of an inch long. The head is prolonged into a stout beak. The larvae are prevalent under dead bark in the fall causing numerous irregular galleries. The adults emerge in the spring.

C. *Gaurotes cyanipennis* is a strikingly pretty beetle about one-half of an inch long. The head and thorax are black, antennae reddish, and the wing covers a brilliant green. The larvae bore beneath the bark of dead trees, and later pupate in the earth or humus.

D. *Leptostylus macula* is common in dead wood and twigs, pupating beneath the bark in June. The adult is about one-quarter of an inch long, chestnut brown with ash-gray markings. The antennae are quite long, the body small and thick.



## Other Insect Enemies

*Halisidota caryae*—Hickory tussock moth. Snowy-white, black-tufted caterpillars which feed on the foliage. See insects attacking hickory.

*Tropea luna*—Luna moth. Defoliator. See insects attacking birch.

*Hemerocampa leucostigma*—Defoliator. See insects attacking elm.

*Typophorus canellus*—Minute brown, black marked beetle in May and early fall, eating small holes in leaves.

*Colastus truncatus*—Small oval reddish brown beetle beneath bark of freshly cut butternut stumps.

*Cryptorhynchus parochus*—Small snout beetle. Larvae found beneath bark.

## INSECTS ATTACKING CEDAR

The insects attacking the common white cedar of the north are listed under Arbor Vitae. The coast white cedar and the red cedar do not occur in any abundance in this State.

## INSECTS ATTACKING CHERRY

Three species of cherry are found in this State, the wild red, wild black, and choke; of these the wild black cherry is the only one of any economic value from a timber stand point. There are few outstanding insect pests, as here again the trees are found scattered thru the forest.

### American Tent Caterpillar

*Malacosoma americana*

The unsightly nests of this insect are very conspicuous in the early spring, especially on exposed cherry trees. The caterpillars are velvety black with a white line along the middle of the back, and alternate dots of blue and white along either side. After about five weeks feeding the larvae are approximately two inches long. As they feed they spin a web or tent over the limb. The moths are dull reddish brown with two

white oblique lines across the fore wings. They have a wing spread of about one and one-half inches. The eggs are laid in broad ring-like masses which encircle the twigs. The edges of the egg mass taper off rather than being cut off abruptly as in the case of the forest tent caterpillar. The egg masses are covered with a varnish like substance which protects them from weathering. The eggs hatch the following spring. It is very noticeable in nature that when an insect passes the winter in the egg stage these eggs are usually protected by some substantial coating.

### Cherry Leaf Beetle

*Galerucella cavicollis*

This small, smooth, blackheaded, dull red beetle is only about one-fifth of an inch long. Its antennae are black and its legs dull red. During midsummer it is found eating irregular round holes in the leaves. The oval yellowish eggs are laid on the base of the trunk or on any debris near the base of the tree. The young larvae ascend the tree and feed on the foliage for from ten to twenty days before pupating.

### Oblique Banded Leaf Roller

*Archips rosaceana*

The larvae of this insect vary considerably in color from a pale yellowish-green to almost a brown. The head is brown, and the body about three-fourths of an inch long. In early June the larvae draw together the young leaves at the ends of the limbs, forming a web about them, within which they secrete themselves. The moths appear in June.

### Cherry Worm

*Archips cerasivorana*

In midsummer the leaves of choke cherry are often webbed together by yellow, blackheaded caterpillars, an entire brood living in a single nest. The larvae pupate within the nest and when about to transform, work their way to the outer portions of the nest. In July the moths appear. These have a wing expanse of about one inch. The wings are bright ochre yellow, the front pair being marked with brown spots and transverse slate colored bands. Comstock in his 'Introduction to Entomology' calls this insect the cherry-tree ugly-nest tortricid.

**Io Caterpillar***Automeris io*

This defoliating insect is particularly interesting as it is one of our very few poisonous caterpillars. When full grown it is a large greenish caterpillar with a broad brown or reddish stripe edged below with white on either side. The body is covered with fascicles of irritating sharp black-tipped spines. The moths have a wing spread of three inches. The ground color is purplish-red, with purple centered eye spots on the hind wings.

**Cecropia Moth***Samia cecropia*

The larvae of this insect feed on a large number of different food plants. When full grown the caterpillars are four inches long. They are pale green, with conspicuous green, blue, yellow and red tubercles. The moth has a wing expanse of from five to six inches. The ground color of the wings is dusky brown. They are crossed near the outer edge by a white band broadly margined on the outer edge with red. The other edge of the wing is clay colored. Each wing bears near the center a crescent shaped white spot, and near the apex of the fore wings is a red spot.

**Round-headed Apple Tree Borer***Saperda candida*

This strikingly marked beetle is light brown with two white bands joined at the front and extending back to the tips of the wings. The underside of the beetle and the front of the head is white. The legs and antennae are gray. The beetles appear in June and lay their pale rusty brown eggs in slits made in the bark near the base of the trunk. The eggs are cemented into the slit with a gummy fluid. The larvae bore beneath the bark, usually working downward, girdling the trees. The insect requires two years to mature.

**Common Flat-headed Borer***Chrysobothris femorata*

The larvae of this insect bore in the sapwood just beneath the bark, later entering the heartwood where the winter is passed. The adult is a metallic, grayish, flattened beetle about three-fourths of an inch long. They appear in the early spring and are particularly conspicuous when flying on account

of their brilliant greenish-blue abdomen. Eggs are deposited on the bark of the tree. The grubs are slender and legless. The body segments just behind the head are greatly dilated, giving it the name flat-headed borer.

### Round-headed Borer

*Neoclytus erythrocephalus*

This beetle is long, slender, cylindrical, reddish-brown, with four narrow cross-bars of bright yellow pubescence on the wing covers. The larvae mine beneath the bark completely honey-combing both the sapwood and outer heartwood. The larvae are slender and sparsely covered with long whitish hair.

### Clear Wing Moth

*Synanthedon pictipes*

This moth is of a blue-black color with large clear transparent areas on the wings. The moths fly in July, laying their eggs on the rough bark of cherry and other trees. The larvae bore just beneath the bark. They are seldom injurious.

### Plum Curculio

*Conotrachelus nenuphar*

This is a dark brown snout beetle about one-quarter of an inch long, which feeds first on the foliage and new twigs and then attacks the fruit. The beetle cuts a slit in the fruit in which the egg is laid. The larvae completely spoil the fruit by tunneling through it. After the fruit falls, the larva enters the ground where it forms an earthen cell in which it changes to the adult or beetle stage. The beetles hibernate through the winter in protected places.

### Other Insect Enemies

*Malacosoma disstria*—Forest tent caterpillar—defoliator.  
See insects attacking birch.

*Euproctis chrysorrhoea*—Brown tail moth—defoliator. See  
insects attacking oak.

*Hemerocampa leucostigma*—White marked tussock—defoliator. See insects attacking elm.

*Selandria cerasi*—Slug-like larvae on wild cherry.

*Paronix quadripunctella*—Leaf miner.

*Rhagoletis cingulata*—A fairly large fruit fly.

*Dicerca divericata*—A brassy flat-headed borer.

*Eccoptogaster rugulosus*—Bark beetle

*Phthorophloeus liminaris*—Bark beetle.



## INSECTS ATTACKING CHESTNUT

Altho the chestnut has been practically annihilated from the New England forests by the chestnut blight, it seems best to consider some of the more important insects which affect the tree.

**Two-Lined Chestnut Borer***Agrilus bilineatus*

Chestnut trees are very often killed by this insect. The injury shows up first in the tops of the trees which begin to die. The beetles which fly in May and June are about three-eighths of an inch long. They are slender, black with a slight greenish tinge, sparsely clothed with a light golden yellow pubescence. The eggs are deposited in the spring on the tree. The grubs work in the inner bark and outer sapwood forming numerous flattened transverse galleries which may be found from the top to the base of the tree. The full grown grub is one-half inch long, creamy-white, with a pair of brownish anal forks. The larvae transform into the pupal stage in the spring. This stage lasts about two weeks. The pupal case is made either in the bark or the outer sapwood.

Dead and dying trees should be cut and destroyed or removed from the forest. In Europe it is the practice of foresters to girdle a few trees which act as traps. These trap trees attract beetles which may be in the vicinity. Once infested, these trap trees are destroyed.

(Chittenden, F. H., Two-lined Chestnut Borer, U. S. D. A. Bur. of Ent., Circ. No. 24, Revised Edition;—1909)

**Chestnut Timber Worm***Melittomma sericeum*

The larvae of this slender, chestnut-brown, yellow haired beetle tunnel both the sapwood and heartwood of chestnut in all directions. When full grown they are about three-fourths of an inch long. The adult beetle is about one-half inch long. The insect usually enters the tree through wounds.

The habit of blazing trees has been the cause of much damage in starting wounds. Here again dead trees should be removed.

(Felt, E. P., Manual of Tree and Shrub Insects, Pp. 187-188;—1924)



**Chestnut Weevils***Balaninus proboscideus*, *B. rectus*

People know these insects principally in the larval stage after the unfortunate experience of biting into wormy chestnuts. The beetles are particularly interesting owing to their extremely long beaks, which are in some cases nearly twice the length of the body. The beetles appear when the chestnuts are in bloom and with their long beaks pierce the bur and lay their eggs in the kernel. One or more eggs may be deposited in a single hole. The injury to the husk and shell soon heals over. The young larvae feed within the kernel and when full grown chew their way out and pupate in the ground. Doctor Felt states that the adults may appear the following spring or hold over until the second season. It is claimed that squirrels are particularly fond of the larvae and have been seen to discard unfested nuts.

**Other Insect Enemies**

*Alsophila pometaria*—Fall cankerworm. See insects attacking ash.

*Ennomos magnarius*—Measuring worm—defoliator.

*Apatela oblongata*—A defoliating caterpillar.

*Lithocolletis macrocarpella*—Leaf miner on upper side of leaves.

*Sesia pictipes*—Blue-black clear wing moth. Larvae bore beneath bark.

*Urographis fasciatus*—Brown grayish mottled beetle. Wood borer.

*Leptura zebra*—Beautiful black, golden marked beetle, about one inch long. Bores in living chestnut bark.

*Callidium aereum*—Brown flat beetle. Mines in inner bark.

*Eudermes picipes*—Grubs bore in small branches. Adult is ant-like in appearance.

**INSECTS ATTACKING ELM**

Two species of elm occur in Maine—the American and slippery—and these trees have a large number of insect enemies, particularly when planted as shade trees. The early settlers coming over from England brought with them the

idea of planting roadsides with elms and went into the woods after the young trees that later made our New England villages so attractive. In the forest the elm occurs scatteringly and is not so seriously affected as in the case of the large groups of elms found in our towns and cities.

### Elm Leaf Beetle

*Galerucella xanthomelaena*

The elm leaf beetle is the most common, and one of the most serious enemies of the elm. Since its introduction into this country from Europe about 1834 it has spread rapidly, and particularly so during the last twenty years. The adult beetle is about one-quarter of an inch long, greenish-yellow or brownish with black spots on the head and thorax and a dark line along each side of its back. The winter is spent in sheltered places such as barns or often even in houses. In the early spring the beetles fly to the elms and feed on the newly opened leaves. Orange colored eggs are then laid in clusters of from five to twenty-five on the leaves. A female lays about five hundred eggs. These hatch in from five to six days and the young grubs eat ravenously for from fifteen to twenty days, skeletonizing the underside of the leaves, causing them to turn brown and drop. At this time large numbers come down from the trees to pupate. The grubs are yellowish-brown and are particularly conspicuous as they congregate in masses around the base of the tree and in crevices of the bark. The pupal stage lasts about six days. The second generation of beetles appears in the latter part of July and it is at this time that the heaviest defoliation takes place. Repeated defoliations weaken and finally cause the death of the trees.

In controlling this insect under shade tree conditions the following schedule is recommended. The first year the trees should be sprayed with arsenate of lead at the rate of two pounds to each fifty gallons of water just as the beetles begin to appear. With this spray it is not necessary to cover the underside of the leaves. A second similar spray should be applied about three weeks later just as the eggs begin to hatch. It is very essential with this spray to coat the underside of the leaves. In other words, the spray should be shot up through the foliage rather than letting it rain down onto it. Particular care should be made to reach the tops of the trees, for it is

here that the heaviest defoliation takes place. Unless the spray outfit is particularly powerful, it is usually necessary to climb the large elms in order to reach the uppermost limbs. The second year a heavy thorough spray, using four pounds of the arsenate of lead to fifty gallons of water, will very often prove sufficient. The time and amount of spraying necessary is purely a local problem and must be decided by the resident owners. Failures in control are almost invariably due to putting off the time of spraying until the damage has been done. If the second generation appears numerous, another spray in July may prove advisable. When the grubs come down from the trees to pupate they are easily destroyed by pouring a hot solution of water and cheap laundry soap on them.

(Herrick, Glen W., Control of Two Elm Tree Pests, Cornell Agr. Exp. Sta., Bul. 333;—1913)

### **White Marked Tussock Moth**      *Hemerocampa leucostigma*

This insect is rather unusual in that the female moths are wingless. The males are ashy gray in color and are winged. The glistening frothy-looking egg masses are laid on the trunks and limbs of the trees, and are quite conspicuous during the winter months. In the early spring the caterpillars start feeding on the foliage. When full-grown the larvae are about one inch long, with a red head, two long black plumes just behind the head and another at the other extremity of the body. Just behind the fore plumes are four yellow brush-like tufts with two red spots behind them on the back. The larvae start in by skeletonizing the leaves, later eating holes through them, and finally devouring all but the veins. They feed for from four to five weeks and when full grown spin grayish silken cocoons. Two weeks later the moths appear.

Owing to the fact that the female moth is unable to fly, much good will come from banding uninfested trees with tanglefoot. As with all foliage-chewing insects infested trees should be sprayed with arsenate of lead.

### **European Elm Case-bearer**      *Coleophora limosipennella*

This insect during its larval stage lives in a light brown, cylindrical, somewhat flattened, cigar-shaped case, which is about three-eighths of an inch long. From the protection of this case the larva eats a small hole into the leaf and then

stretching from this point of entry eats all of the softer green tissue which can be reached without deserting the case. During July the larvae pupate and the moths appear the latter part of the month. These have a wing expanse of about one-half inch and are golden brown in color. The winter is passed in the larval stage in the cocoons. Doctor Felt reports this pest from southeastern New York. In Europe this insect also attacks birch and alder. The injury shows up as spotted mined areas on the leaves.

(Felt, E. P., Manual of Tree and Shrub Insects, Pp. 83-91;—1924)

### Spiny Elm Caterpillar

*Euvanessa antiopa*

In June clusters of large, black, red-marked, spiny caterpillars may be found defoliating the terminal branches of elms. When full grown they are approximately two inches long. The adult is a butterfly with a wing expanse of about three inches. The wings are black, with blue spots and a yellow border. The yellowish eggs are laid in bands around the smaller twigs. In August or September a partial second generation appears. The winter is spent in the adult stage in crevices or holes in the trees. The larvae are easily destroyed with an arsenical spray.

### Spring Canker Worm

*Paleacrita vernata*

The elm is a favorite food of both the spring and the fall canker worms. The moths of the spring canker worm emerge in the early spring and lay their iridescent eggs in loose clusters in crevices of the bark, usually on the branches. The eggs hatch the latter part of May. The color of the larvae varies from a yellowish-brown to a yellowish-green. The head is dirty white mottled with brown. When full grown the larvae are about three-fourths of an inch long. They feed for about a month on the foliage and then enter the ground where they pupate and spend the winter. The adult female is wingless and climbs the tree in order to lay its eggs. The male has a wing expanse of three-fourths of an inch. Its fore wings are a delicate semi-transparent brownish-gray. The hind wings are of a pale ashy gray.

As the female moths are unable to fly, unfested trees may be protected by banding them with tanglefoot early in the



spring before the moths emerge. Infested trees should be sprayed with arsenate of lead.

### **Elm Sawfly**

*Cimbex americana*

About the first of July a large wasp-like insect with a body length of about an inch and a wing spread of about two inches may be seen flying about the elms. The body of the insect is steel blue and the head black. It has four transparent wings. After mating, the female cuts a slit in the fleshy part of the leaf and thrusts an egg into this pocket. This causes a blister to form on the leaf. Upon hatching, the young larva comes out to feed on the foliage, becoming full grown the latter part of July. The larva is a cylindrical, coiled, yellowish-white worm, with a black line down the middle of its back. Pupation takes place in a coarse brown silken cocoon made just below the surface of the ground. The insect is seldom numerous enough to be a serious pest but is often sent in for identification. It is easily controlled with an arsenical spray.

### **Elm Bark Louse or Scale**

*Gossyparia spuria*

The underside of elm limbs are at times thickly coated with reddish wooly-bordered bark lice, about one-tenth of an inch long. The winter is spent as partly grown lice hibernating in crevices of the bark. Early in July the young lice, which at this time are of a yellowish color, feed on the leaves and leaf stems. Later they migrate to the branches and limbs. In the cities the lice are carried from tree to tree by birds, as the females are wingless. They are fairly easily controlled by spraying the trees during the dormant season with miscible oil, using one part of the oil to fifteen parts of water. This is in reality a scale insect and was introduced from Europe.

(List, G. M., The European Elm Scale, Colo. Agri. College Circ. 29;—1920)

### **Wooly Elm Bark Aphis**

*Eriosoma rileyi*

This insect occurs in white flocculent masses on the bark of elm where it spends its entire life. Its feeding causes roughened knots and gnarls on the twigs and branches particularly of young trees.

**Elm Borer***Saperda tridentata*

About the first of June a strikingly marked beetle about one-half inch long may be seen laying its eggs in the bark of elm. This beetle is gray in color with rusty-red markings as follows: A curved line behind the eyes, two stripes on thorax, and a long stripe on the outer edge of each wing cover with three long points projecting inwards. The gray ground color is somewhat mottled with black. The insect is usually well established before its presence is recognized. The injury shows up first as light thin foliage, then dead limbs appear, and dark brown frass or sawdust begins to collect in the crevices of the bark. Later large portions of the bark may be peeled off. The winter is spent in the larval stage and the insect pupates about the middle of May. Infested parts of the tree should be cut and burned.

(Felt, E. P., Monograph of the Genus *Saperda*, N. Y. State Mus., Bul. 74, Pp. 44-50;—1904)

**Elm Bark Beetle***Hylurgopinus rufipes*

This small dark brown beetle about one-tenth of an inch long, with its wing covers marked with deeply impressed punctured furrows, mines under the green bark of dying and sickly elms.

**Elm Snout Beetles***Magdalis barbata*, *M. armicollis*

The injury caused by these insects shows up as dying or dead limbs, the inner bark of which is infested with curved legless grubs. Later the outer bark shows numerous small circular exit holes.

**Other Insect Enemies**

*Ceratonia amyntor*—Larvae with conspicuous caudal horn appearing in September on elm.

*Apatela americana*—Yellowish short-haired, black headed caterpillar.

*Hyphantria cunea*—Fall webworm. See insects attacking ash.

*Porthetria dispar*—Gipsy Moth. See insects attacking oak.

- Euproctis chrysorrhoea*—Brown tail moth. See insects attacking oak.
- Kaliosyphinga ulmi*—Leaf miner. Particularly on Scotch and English elms.
- Kaliofenusa ulmi*—An introduced sawfly leaf miner, causing irregular blister-like areas on the foliage. Larvae leave mines latter part of June and pupate in ground. Adults appear the following May.
- Schizoneura americana*—Curled and twisted leaves containing numerous mealy covered aphids.
- Callipterus ulmifolii*—Small green plant lice. Numerous on the foliage in midsummer.
- Lepidosaphes ulmi*—Oyster shell scale. See insects attacking ash.
- Physocnemum brevilineum*—Brownish to purple beetle, bores in elms, particularly in outer bark.
- Tremex columba*—Pigeon tremex. Bores in dead wood. See insects attacking maple.
- Tibicen linnei*—Dog-day cicadas or harvest flies. Singing in trees in August. See insects attacking oak.

## INSECTS ATTACKING FIR

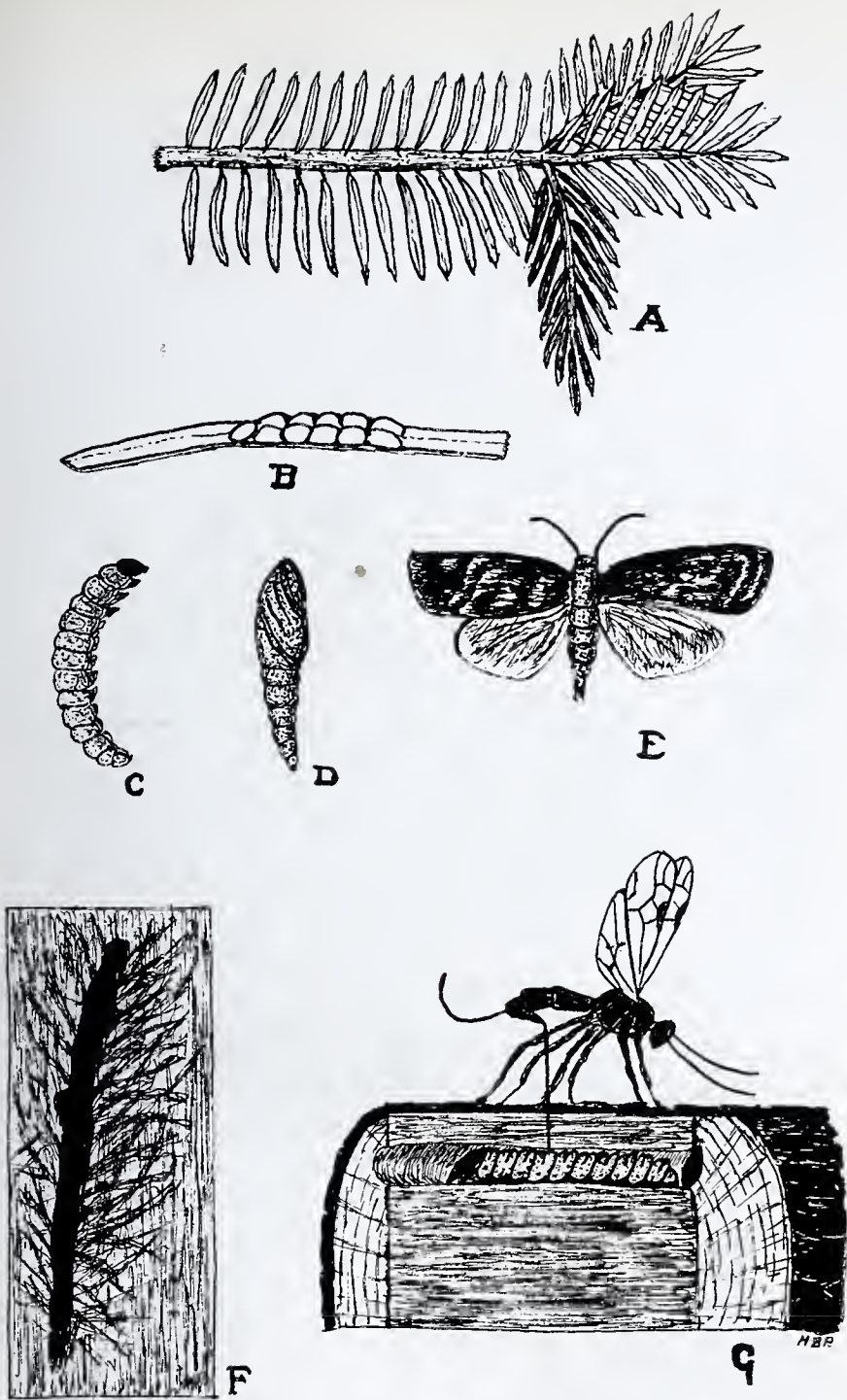
Balsam fir is quite generally distributed throughout Maine. The tree is generally associated with other conifers and in the northern two-thirds of the State stood second in volume only to spruce before the last series of budworm outbreaks. The percentage of fir in our northern forest is continually increasing. The balsam seeds every year and the seedlings being more rapid growers than spruce are far better able to penetrate the leaf litter and get their root systems established before the dry season starts. Following severe defoliation fir is apparently influenced by some natural law which causes the tree to bear a heavy crop of seed in order to insure the continuity of the species. So it is that succeeding each budworm outbreak we may expect an ever increasing amount of fir to come in. The spruce budworm is such a serious enemy, its other insect pests rarely have an opportunity of assuming epidemic form.

**Spruce Budworm***Cacoecia fumiferana*

Without question the most dangerous forest insect in the Northeast is the so-called spruce budworm. The tremendous havoc to the spruce and fir forests of Maine and Eastern Canada caused by this insect's depredations has never been fully brought to the attention of the public. It is not a new insect, for repeated wholesale destruction of forests in the past is a matter of record. To quote from Maine Forest Service Bulletin No. 1. "The earliest record in regard to the dying of spruce in the forests of the northeast is found in a letter quoted by Packard. This letter, written in 1818, mentions great destruction of spruce east of the Penobscot River. Very little was written on this outbreak due to the fact that at this time very little spruce and no fir was being cut, pine being the principal timber tree lumbered. The next great series of outbreaks started about 1874 and by 1880 were wide spread. The destruction wrought at this time brought forth much more attention, for spruce was being cut in large quantities. Such reports as: 'One billion feet of spruce were killed along Alleghash and tributaries of the St. John River;' 'Great destruction of spruce in north Somerset County;' and 'The slump in the amount of spruce coming down the river after the outbreak was very noticeable'—are common. Subsequent studies of ring retardation in spruce throughout the State have not only corroborated the above reports, but have shown outbreaks as far back as 1770." That budworm outbreaks have been somewhat periodic in the past has apparently been due largely to the rotation of the balsam fir crop. Once the fir has been killed, another outbreak is not likely to start until a new crop has come into existence. Due to continual cutting operations new areas of fir are constantly reaching the point where they will support outbreaks, i.e., the fir has worked its way up into the sunlight, which seems to be a condition particularly favorable for egg laying. The larvae of the budworm also feed on black, red, white and Norway spruce, hemlock, larch and white pine.

The winter is spent as minute first stage larvae scarcely one-sixteenth of an inch in length, in winter cocoons or hibernaculum usually made among the bud scales. These cocoons are





A. Fir tip on which feeding has started. B. Egg mass of Budworm on fir needle (greatly enlarged). C. Larva of Budworm (Enlarged  $1\frac{1}{2}x$ ). D. Pupa of Budworm (Enlarged  $1\frac{1}{2}x$ ). E. Moth of Budworm (Enlarged  $1\frac{1}{2}x$ ). F. Barkbeetle tunnel beneath bark, showing large adult tunnel and small larval tunnels (Natural size). G. Parasitic Hymenopteron laying egg in wood boring larva (Natural size).

formed by lining the small cavity with silk and then covering it with a tent-like structure. The young larvae have a dark brown shiny head and a yellowish-green body. The second stage larvae emerge from the winter cocoons a few days before, or just as the balsam buds open. The larvae enter the buds either directly through the base or between the opening scales, hollowing them out. In this way large numbers of buds are destroyed before they open. The larvae then begin to feed on the terminal twigs eating the tender new growth needles. As the larvae develop they bite the needles off at the base and attach them loosely together with silk, forming a loose shelter made up of dead needles, frass, bud scales, etc. When defoliation is severe this gives the individual trees, and entire forest tracts, the appearance of having been scorched by fire. Even the softbark of the new growth twigs is gnawed by the larvae. During the latter stages the larvae do the greatest amount of feeding and at this time may feed on the old growth needles or may migrate to the new growth on spruce. Vast numbers of them drop by means of silken threads on to the under story of spruce and fir where considerable damage may be done. In general the larvae tend to work upwards. When full grown or in the sixth stage the larvae are approximately one inch long. The head is dark brown, streaked with reddish-brown. The body is cylindrical, tapering towards the ends, of a dark brown to reddish-brown color with rather conspicuous yellowish-white tubercles. The thoracic feet are a shiny dark brown, the prolegs about the color of the ventral side of the body which is of a slightly paler color than the dorsal or upper side. After from three to four weeks of feeding, the larvae form loose cocoons of silk and needle remains, which are attached to the twigs by means of silk threads. The pupae are about one-half inch long and change in color from a pale cream to a dark reddish-brown. They are moderately slender, tapering towards the anal extremity. This stage lasts for a period of from six to twelve days.

The time of emergence of the moths depends largely upon climatic conditions and may occur from as early as June 15 to as late as July 20. The moths are quite variable in color and markings. The predominating form is of a dull gray color, the forewings being overlaid with bands, streaks, and spots of

brown giving them a checkered appearance. In the middle of the upper margin of the fore wings is a rather large conspicuous whitish spot. The fore wings have an expanse of about seven-eighths of an inch. The hind wings and body are of an almost uniform gray to umber-brown color. The antennae are a little more than half the length of the fore wings. The eyes are prominent, black, streaked with gray.

The flight of the moths has never been carefully studied, but from observations made in Maine in tracing up the spread of epidemics by a study of ring growth, it is apparent that the prevailing wind is a dominant factor. In several river valleys the advance was at least six miles per year and as food becomes scarce the moths may fly in great clouds for many miles.

The eggs are laid on the underside of needles of spruce or fir trees whose tops are in the sunlight. The individual eggs are one-sixteenth of an inch in diameter, scale-like, oval, of a slightly paler green than the needles. The under surface of the eggs is flat, the upper surface convex. The eggs are laid like shingles overlapping each other so that about one-third of the egg is exposed. A female lays about one hundred and fifty eggs in masses of about twelve each. The eggs are laid both day and night when the temperature ranges between sixty-two to eighty-nine degrees Fahrenheit. The lower or first egg laid is the first to hatch and so on in order. The eggs are laid the latter part of July and may hatch in from five to seven days. The young larvae require about twenty minutes to chew their way out of the egg. There seems to be some doubt as to whether the young larvae feed any before going into hibernation for the winter. They may wander about for several days before finding a suitable place to spin their cocoon.

Much can be done that will aid in preventing outbreaks of the bud worm, for we know that outbreaks start in stands containing a high percentage of balsam. First it seems advisable that a short rotation be planned for all stands containing over thirty-five percent balsam. In cutting operations it would seem wise to clean cut the balsam and possibly leave some spruce seed trees. The maintaining of the forest as mixed growth will of course greatly lower the danger from insect attack.



In the matter of control it is first advisable to have the area to be protected mapped in such a way that all areas where outbreaks are likely to start will be known. These areas should be carefully watched for possible outbreaks and the owners notified immediately if one is located. It has definitely been proved that if a cutting operation is put in on the infested area in time and the area clean cut the outbreak can be stopped. This is based on the fact that the young larvae in coming out in the spring will die from starvation unless green food is close by. Cutting dries up the buds and foliage so that they are not suitable for the insect to feed upon.

Two other means of control still remain to be fully tried out in the hope that inaccessible areas may likewise be protected. Several large sample plots have been laid out where the effects of girdling spruce and fir at different seasons of the year in an effort to quickly dry up the foliage is being tried. The dusting of infested areas from an airplane still remains to be tried out.

(Swaine, Craighead and Pailey. Studies on the Spruce Budworm, Bul. 37, n. s., Dept. of Agri., Ottawa;—1924)

(Gibson, Arthur. Observations on the Spruce Budworm. Trans. Royal Soc. of Canada, Vol. 19, Third Ser. Pp. 195-205;—1925)

(Peirson, H. B., Insects attacking Forest and Shade Trees, Bul. No. 1, Maine Forest Service, Pp. 8-25;—1923)

(Peirson, H. B., Estimating Forest Insect Damage, Bul. No. 3, Maine Forest Service;—1924)

## Fir Sawfly

*Neodiprion abietis*

This insect at times becomes a serious pest to fir in Maine and has been particularly prevalent in pasture grown stands near the coast that were not previously damaged by the bud worm. The life history of this insect has, at the present time, not been fully worked out. The larvae feed in midsummer on the foliage of both spruce and fir, and when full grown they are about one-half inch long. The body of the larva is green with a dark green stripe along the upper side. Its head is black. The larvae very commonly feed in clusters and when disturbed curl up their bodies into an 'U' shape.

When very numerous, cutting of infested trees has been resorted to. Around estates infested trees should be sprayed with arsenate of lead at the rate of two pounds of the powder to fifty gallons of water. Owing to the smoothness of the needles, the addition of one pound of dissolved laundry or



fish oil soap will aid materially in causing the spray to stick to the foliage.

### **Fir Needle Inch Worm**

*Eupithecia luteata* (?)

This insect is reported by Packard as injurious to fir in Maine. The larvae belong to the family of measuring worms and have a remarkable resemblance to a dead fir leaf. The body is flat, tapering at both ends, of a reddish tinge, covered with minute white papillae. Along the back is a faint somewhat broken black line. The head is small and much narrower than the body. The underside of the body is of a whitish-green color. When full grown they are about three-fourths inch long. In late August or early September they form a chrysalis in which the winter is spent. The moths emerge the following June and have a wing expanse of about one inch. The wings are crossed by four parallel lines.

(Packard, A. S., Fifth Rept., U. S. Ent. Comm., Pp. 865-866;—1890)

### **Red-head Inch Worm**

*Semiothisa bisignata*

Packard reports this insect as feeding on fir in Maine. As is the case with the preceding insect it is admirably colored to protect it from casual observation. When full grown it is of about the same length and width as a fir needle. The head is green in the middle and bright red on the sides. The body is pale green with a broad dorsal whitish line the same color as the underside of a fir leaf. The thoracic legs are reddish. Feeding takes place during July and early August. The latter part of August it pupates in the ground. The moths appear the following June. The head and antennae are a bright reddish ochre. The body and wings are a whitish-ochre, speckled with brown. The fore wings are crossed by three brown lines.

(Packard, A. S., Fifth Report, U. S. Ent. Comm. Pp. 780-781;—1890)

### **Balsam Gall Midge**

*Cecidomyia balsamicola*

This interesting insect causes an oval enlargement or gall near the base of the needles. On cutting one of these needles open a yellowish maggot will be found feeding within the gall. The adult fly is apparently unknown. Foliage which has been affected by this insect usually drops off during the winter.

**Balsam Sawyer***Monochamus marmorator*

The presence of this insect usually shows up first as individual sprays of foliage turning yellowish-brown and later reddish-brown. If the undersides of such sprays are examined it will usually be found that the bark has been chewed off in patches of from one-half to one inch in length. The adult causing this injury is a beautiful beetle of about three-fourths to one inch in length. The color of the wings is yellowish-brown with mottled white and tan spots. The antennae are as long or longer than the body. The legs are long and strong. The beetles appear during the first of July and fly to the tops of green trees where they feed for about two weeks, chewing notches in the leaves, giving them a sawlike appearance, and feeding on the underside of twigs causing the injury previously mentioned.

The beetles then come down at night onto the trunk and selecting places close to gum blisters, gnaw a small transverse ragged slit about one-quarter of an inch long. The ovipositor is then thrust deeply into the center of this slit and an egg laid. These egg scars or slits cause a large amount of pitch to flow from the wound down the trunk. In about three weeks the eggs hatch and the young larvae start mining in the bast. In the fall about half of the larvae have matured far enough so that they enter the wood. The others remain in or under the bark. In June some of the larvae pupate and transform into adults while a portion or at times all of the larvae may remain in the wood until the second season. The larval mines are usually tightly packed with frass and may extend in a horizontal direction for a distance of from six to twelve inches. It is in this way that the trees are girdled and killed. An effort should be made, wherever possible, to cut and salvage by putting in water, all affected logs.

(Swaine, J. M. and Craighead, F. C., Studies on the Spruce Budworm, Bul. 37, n. s., Dept. Agr., Ottawa, Pp. 20-22;—1924)

**Balsam Bark Weevil***Pissodes dubius*

The basal third of fir trunks is at times heavily infested by a snout beetle slightly less than three-eighths of an inch long. This beetle is of a grayish-brown color mottled with black and white. Its head is produced into a curved beak about half the

length of the body. The winter is spent by the adults hibernating in the leaf litter. Soon after the balsam buds open the beetles again appear and after several weeks, or about the middle of July, start laying their eggs in punctures made in the bark. Pitch masses collect at these punctures. The larvae, which are curved, legless, whitish grubs, make long straight or slightly wavy tunnels radiating from a common point just beneath the bark. In case the attack on the tree is successful, the larvae pupate in cells formed deep in the wood. The adults emerge the following season so there is in reality a two year life cycle.

(Swaine, J. M. and Craighead, F. C., Studies on the Spruce Bud Worm, Bul. 37, n. s., Dept. of Agri., Ottawa, Pp. 19-20;—1924)

### **Black Carpenter Ant** *Camponotus herculeanus pennsylvanicus*

These large black ants enter trees, particularly fir, spruce, pine and cedar, through wounds, and form their nests in the wood. The base of the trees may be completely honeycombed up to a height of three feet. The ants eat out the soft spring wood, leaving the harder summer wood, so that the nest is really a great series of galleries connected by many cross passages. In the winter the ants bunch together in the nest so that they can be picked up by the handful. Old woodsmen tell of eating them in this half frozen condition when they are said to have a pear-like taste.

### **Balsam Bark Beetle**

*Pityokteines sparsus*

This minute slender brownish black bark beetle approximately one-tenth inch long is a primary enemy of the balsam fir. It is reported to be the only bark beetle found mining beneath the bark on the trunks of green balsam. The numerous interlacing galleries deeply score the wood. The galleries radiate from a central chamber. Egg notches along the sides are very prominent. This beetle is apparently able to kill trees very quickly. Dying trees are easily spotted as the foliage turns red on them.

(Felt, E. P., Manual Tree and Shrub Insects, Pp. 268-269;—1924)

## Other Insect Enemies

*Mindarus abietinus*—Balsam twig aphid. Often abundant in early part of season causing needles to curl and at times killing twigs.

*Serropalpus barbatus*—Blazed tree borer. A slender whitish grub. The insect enters wounds on living trees boring deep into the sapwood and heartwood causing rapid decay of infested parts.

*Monochamus scutellatus*—Black sawyer. A large black beetle which is particularly injurious to logs. See insects attacking pine.

*Monochamus titillator*—Southern pine sawyer. A large long-horned beetle of a reddish-brown color, diffused with ashy areas. Larvae injurious to logs. See insects attacking pine.

*Buprestis maculiventris*—A large metallic brassy brown somewhat oval beetle with reddish-yellow spots on each side of the abdominal segments. On balsam in June and July.

*Pissodes similis*—A small brown weevil which attacks dead branches and witches brooms of balsam fir.

*Pissodes strobi*—White pine weevil kills terminals. See insects attacking pine.

*Dioryctria decuriella*—Fir cone worm. Possibly the same as the spruce cone worm. See insects attacking spruce.

## INSECTS ATTACKING HEMLOCK

Hemlock occurs practically throughout the State. Its insect enemies are relatively few in number. During the last few years, several species of measuring worms, commonly called loopers or span-worms, have become very abundant in the region of the northern range of this tree. Several sections have reported very serious damage. In areas where the spruce



budworm was prevalent considerable hemlock has been reported as being killed, probably by the overflow of the larvae from spruce and fir.

### **Hemlock Span-worm**

*Ellopija fuscicollis*

This insect is known from Vancouver to Labrador and at times kills large amounts of hemlock. Comparatively little is known about its life history and habits at the present writing. The larvae feed on the foliage, preferring the new growth, from the middle of June to early August. The large whitish moths emerge in September and immediately lay their eggs. Hemlocks that have been completely stripped die immediately, whereas those only partially stripped may at times survive, altho the growth is retarded for a considerable time. The hemlock span worm is also reported as attacking balsam fir and pine.

### **Evergreen Span-worm**

*Nepytia contracta*

Reported by Doctor Felt in New York State as attacking hemlock.

### **Hemlock Scale**

*Aspidiotus abietis*

This oval dark gray scale is at times quite numerous on the underside of hemlock leaves. The scale is about one-tenth of an inch long and is often black with a gray margin. At times the scale may even take on a bluish, brownish, or purplish tinge.

### **Flat-headed Hemlock Borer**

*Melanophila fulvoguttata*

During midsummer a somewhat flat, dark brownish-bronze beetle may be seen laying its eggs in the crevices of the bark. The beetle is from three-eighths to one-half inch long and approximately one-third as wide. There are three yellow spots on each wing cover. The larvae are long and narrow with the prothorax, which is commonly called the head, very wide and marked with an inverted 'V'. The true head is brown and very small. The larvae make winding shallow burrows between the inner bark and sapwood. These burrows shut off the flow of sap causing the death of many trees. The winter is passed by partially grown larvae beneath the bark. They become full grown the latter part of June. Woodpeckers

very commonly strip the bark off from infested trees in search for these larvae. Infested trees should be cut in the winter and the infested bark removed and burned.

(Blackman, M. W., & Ellis, W. O., Vol. 16, No. 26, Pp. 49-52, Bul. N.Y. State College of Forestry;—1916)

### Canadian Leptura

*Leptura canadensis*

During July this large handsome beetle may be seen flying around dead hemlocks. It is three-fourths of an inch long, black except for the basal portion of the wing covers which are deep red, and the middle of the antennal joints which are broadly ringed with pale red. The large, stout, fleshy, round-headed grubs of this beetle mine beneath the bark and later in the sapwood of dead hemlock. The insect also attacks spruce.

### Lesser Prionus

*Orthosoma brunneum*

Altho of no economic importance this beetle attracts considerable attention on account of its size. It is from one to one and a half inches long, of a light shiny chestnut-brown color. The larvae bore in decaying hemlock and a few hardwoods such as oak.

### Round-headed Hemlock Borer

*Xylotrechus fuscus*

The larvae of this beetle are reported to feed between the bark and wood of hemlock, entering the wood when about half grown, where they make extensive mines. The trees are attacked until well decayed, the larvae continually going in deeper as the wood softens from decay.

### Other Insect Enemies

*Cacoecia fumiferana*—Spruce budworm. A defoliator. See insects attacking fir.

*Tolyte laricis*—A dull rusty-brown irregularly white-spotted flattened larva with a series of grayish tufts on each side of body.

*Semiothisa bisignata* (?)—A red-headed, green-bodied, inch worm.

*Recurvaria apicitripunctella*—Hemlock leaf miner.

## INSECTS ATTACKING HICKORY

Three species of hickory—the bitternut, shagbark, and pignut—occur in the southern part of the State. The trees are fed upon by a large number of insect pests, only the most important of which will be mentioned.

**Hickory Tussock Moth***Halisidota caryae*

During July, August, and September, white hairy caterpillars may be found feeding in clusters on the foliage of hickory. The caterpillars are covered with short tufts of white hairs. Along the back is a row of eight black tufts. The head and body are covered with small black tubercles. In the fall the larvae come down from the trees and secrete themselves under stones, in crevices along fences, or under rubbish where they spin their oval ashy-gray cocoons. The following June the brown moths with a wing expanse of about one and one-half inches appear. The fore wings are light brown, spotted with silvery white, the veins being indicated by darker lines. The eggs are laid in patches about an inch long on the underside of the leaves. This insect feeds on a large number of other hardwood trees.

**Hickory Bark Beetle***Scolytus quadrispinosus*

This is probably the most serious enemy of the hickory and frequently assumes epidemic form when large amounts of timber may be killed. The presence of this insect shows up first as wilting leaves, dead twigs and limbs, or fine particles of sawdust in crevices of the bark. The beetles are dark brown to black and about one-fifth of an inch long. They appear from early July to the middle of August when they bore into young twigs, the terminal buds and the green nuts. They then attack the larger limbs and trunks. The females make vertical tunnels beneath the bark, laying from twenty to forty eggs on the sides in small notches. These eggs hatch into small larvae which tunnel out at right angles to the parent or egg tunnel. These tunnels score the wood leaving a large centipede-like figure. The downward flow of sap is cut off and the trees die rapidly. Badly infested trees should be cut in the winter and hauled out for fire wood.

(Felt, E. P. Manual of Tree and Shrub Insects, Pp. 49-51;—1924)

**Red-edged Saperda***Saperda laterialis*

This beetle attacks injuries near the base of trees or sprouts, working between the dead and the green growth. The adults appear in June. The beetles are of fair size with rather long black antennae. They are covered with a brownish-black pubescence above and gray below. A lateral orange-red band extends from the eyes along the sides of the head, thorax, and wing covers where it joins a sutural band.

(Felt, E. P. & Joutel, L. H., N. Y. State Mus. Bul. 74, Pp. 59-62;—1904)

**Hickory Saperda***Saperda discoidea*

Following the work of the hickory bark beetle, diseased or dying trees are frequently attacked by this insect. The beetles appear in June and July. The two sexes vary both in color and size. The male is one-half inch in length, black to light reddish-brown in color, covered with a sparse gray pubescence. The female is three-fourths of an inch long, with a yellow pubescence on head and thorax and yellow markings on the brown wing covers. The larvae feed partly on the bark and partly on the wood. When ready to pupate they may enter either the wood or the bark.

(Felt, E. P. & Joutel, L. H., N. Y. State Mus. Bul. 74, Pp. 52-54;—1904)

**Beautiful Hickory Borer***Goes pulchra*

This insect is a snout beetle about one inch long and is beautifully marked with dark brown, silvery, and reddish-yellow pubescence. The beetle deposits its eggs on the trunks of small hickories. The boring of the larva causes a gall to form on the trunk which so weakens the trees that they frequently break off at this point. Old borings on trees that have survived the injury are marked by ugly wounds.

**Hickory Timber Beetle***Xyleborus celsus*

A cylindrical brownish beetle three-sixteenths of an inch long, which makes a short entrance passage into the tree from which numerous branches radiate deep into the heartwood. These holes allow wood staining fungi to enter and cause rapid discoloration of the wood. The beetles have the interesting habit of growing a specie of ambrosia in the tunnel on beds of chewed up chips and on which they and the larvae feed.



### Other Insect Enemies

*Lithocolletis caryaefoliella*—Leaf miner attacking upper side of foliage.

*Coleophora caryaefoliella*—Hickory case bearer on foliage.

*Tropea luna*—Luna moth. Larvae feed on foliage. See insects attacking birch.

*Basilona imperialis*—Imperial moth. Larvae feed on foliage.

*Catocala vidua*—Catocala—foliage feeder.

*Alsophila pometaria*—Fall canker worm. See insects attacking ash.

*Paleacrita vernata*—Spring canker worm. See insects attacking elm.

*Datana angusii*—Striped hickory caterpillar. Clusters of black, yellow-necked, yellow-striped caterpillars about two inches long in midsummer on the foliage.

*Citheronia regalis*—Hickory horned devil. Large bluish-green caterpillar with eight horn-like projections on thoracic segments.

*Zeuzera pyrina*—Leopard moth. See insects attacking oak.

*Hyperplatys maculatus*—Small gray black-spotted beetle bores in dead twigs.

*Chion cinctus*—Banded hickory borer.

*Cyllene pictus*—Painted hickory borer. Closely resembles locust borer.

*Elaphidion villosum*—Maple and oak twig pruner. See insects attacking oak.

*Chramesus hicoriae*—Hickory twig borer.

*Eburia quadrigeminata*—Four marked ash borer.

### INSECTS ATTACKING LARCH

The larch, which is often called tamarack or hackmatack, and sometimes—although wrongly so—juniper, might well be one of our most important forest trees, were it not for its insect enemies which repeatedly destroy large stands of it as they reach merchantable size.

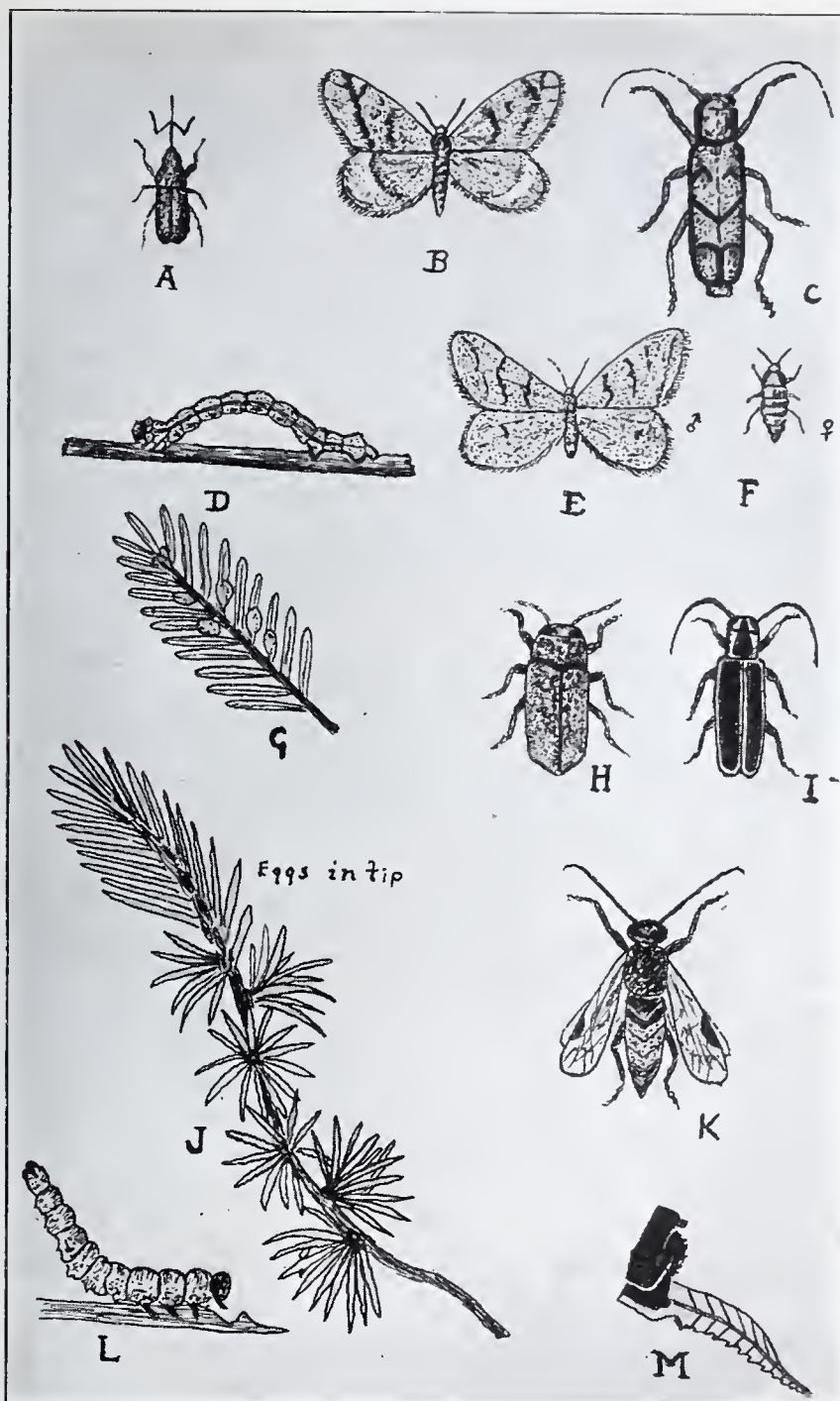
**Larch Sawfly***Lygaeonematus erichsonii*

The larch sawfly is a European pest which has done serious damage to larch forests in North America since 1853 when it attracted considerable notice in Quebec. Between 1880 and 1890 great outbreaks of this insect destroyed many billions of feet of larch throughout the Northeast. In 1882 the eastern part of Maine was swept by this insect. Great areas of larch are again making up a large part of our forests in certain parts of Maine.

Although the larch sawfly is one of the worst of our forest pests, comparatively little work has been done on it. In 1924 a study of its life history was made in the Rangeley Lake region. The season here is about six weeks later than in central Massachusetts. The adults appeared the last week in June. These are about three-eighths of an inch long with rather prominent antennae. The head, thorax, and last three or four segments of the abdomen are jet black. The fore segments of the abdomen are of a shiny reddish-brown. The legs are reddish-brown, except for the mid joints and extremities of the hind legs which are black. The fly has four shiny transparent wings with dark prominent veins. The fore wings have a dark spot midway on the outer margin. They are good fliers, but hover rather closely to the trees from under which they have emerged. The female has an interesting double set of saw-like appliances on the hind end which places this insect in the common group called 'sawflies.' With these saws a slit is made in the new growth twig and the egg is expelled thru the inner blades of the ovipositor into this opening. The eggs are laid in two alternate rows, usually from seven to eleven eggs to a twig, although as many as twenty-six eggs were found in a single twig. The presence of the eggs and the cutting of the slits causes the twigs to curl with the eggs on the inner side. This condition shows for several years.

The eggs are oblong, oval, somewhat transparent, three sixty-fourths of an inch long and one half as wide. No definite data was obtained on the length of the egg stage other than it was quite irregular. Probably about one week.

The minute green larvae crawl to the needles coming out on the previous year's growth and immediately start feeding from the sides of the needle, leaving the mid rib. As the larvae



A. Chestnut Weevil. B. Adult Fall Canker Worm. C. Adult Elm Borer. D.E.F. Spring Canker Worm—larva—adult male—adult female. G. Balsam Gall Midge. H. Adult Hemlock Borer. I. Adult Red Edged Saperda. J.K.L.M. Larch Sawfly—eggs in new growth—adult sawfly (twice natural size)—larva feeding—saw on end of abdomen (greatly enlarged).

mature they consume the entire needle. They are voracious eaters and feed both day and night. When full grown the larvae are about two-thirds of an inch long. The head and six thoracic feet are jet black. The body is of a glaucous green, very similar to the color of the under side of the leaves. When disturbed they assume a 'U' shape with the head and tail up. When feeding there is a tendency for the larvae to work up so that the tops of the trees are usually completely defoliated.

The latter part of July, the larvae come down from the trees and start spinning their pupal cases at a distance of from one and one-half to three inches below the surface of the ground. These cases are tough, oval, and brown in color, nearly one-half inch long by one-sixth of an inch in diameter. The winter is spent in this case.

Unfortunately, little is known as to control measures by forest management. Sometime, dusting of infested stands from airplanes with arsenate of lead or some other poison will probably be resorted to. In 1921 a severe outbreak in one stand of larch was completely stopped by a fortunate heavy two-day rain which beat the larvae off from the trees and drowned them.

In 1913 the Canadian Government imported a shipment of parasitized larch sawfly cocoons. These parasites were liberated in Manitoba and succeeded in establishing themselves. Cocoons collected and examined in 1926 showed a parasitism of sixty-four percent. Such work should be encouraged. In general, fast growing trees are far less liable to succumb, so that larch should be planted only on very favorable sites, and if possible, intermixed with other species.

(Packard, A. S. Fifth Rept., U. S. Ent. Comm. Pp. 879-890;—1890)

## Larch Case Bearer

*Coleophora laricella*

During the season 1923-1925 the larch case bearer was very abundant in Maine and thousands of acres of larch were defoliated. In 1926 trees began to die, which indicated that three or four strippings were all that the trees could stand. This insect is of European origin, and is considered a serious pest on the Continent. It was first recorded in this country at Northampton, Massachusetts in 1886.



The insect is particularly interesting owing to the protective existence which it has evolved. Practically its entire life is spent within a small cigar-shaped case which helps protect it from birds, insects, and climatic conditions which might otherwise soon wipe it out of existence. The caterpillars are, however, very susceptible to late frosts.

The winter is spent as partially grown larvae in these papery cases, which are nothing but hollowed needles. In the spring just as the buds begin to open, the larvae push the fore part of the body out of the case and crawl—the hind part of the body still being in the case—to the new needles. According to Herrick ‘the young larva attacks a leaf in an interesting manner. It eats a tiny hole thru the epidermis of the leaf and mines out the inside tissues of the leaf as far on each side of the entrance opening as it can reach. During this time it does not let go its hold of the case, but remains attached to it by its posterior prolegs and wriggles back into it when disturbed. Attacked leaves soon assume a bleached, whitened appearance and when deserted by the larva they shrivel and curl.’ During heavy infestations the trees look as if they had been swept by fire, whole hillsides and valleys turning brown. As many as fifty thousand larvae have been found on a single twelve year old tree. As the larva grows it splits the case and enlarges it by adding silk. It pupates in this case.

The shiny ashy-gray moths appear about the first of July. The wings are very narrow and delicate and are fringed with long slender hairs or scales. The wing expanse is about three-eighths of an inch. The moths pair in about two days and about a week later begin laying eggs.

The eggs are of a dark orange color and altho very small may be seen by the naked eye. Under a microscope they resemble an inverted scalloped jelly mold. After about a week the eggs turn gray. Several eggs may be laid on a single needle.

Upon hatching, the larvae bore directly through the bottom of the egg shell into the needle where they tunnel through the tissues. They continue feeding until September, at which time they cut off a portion of the hollowed leaf to act as a winter cocoon. Nature then directs them to leave the foliage, which would soon drop off, and to migrate to twigs, branches, and trunk with their cases which they securely fasten for the

winter. During heavy infestations they can be taken off in great clumps. Unlike the larch sawfly, this insect attacks the lower limbs first. The larva within the case is dark reddish-brown, with black head, about one-fifth of an inch long when full grown. The writer has collected the larch case bearer from both white pine and fir where it showed a preference for the opening buds.

European foresters recommend the planting of larch only in places where it has a naturally well drained soil, and managed so that there is a free circulation of air about the crowns. Close planting of larch is therefore not recommended. Mixed plantation are also advised. Under some conditions the pruning and burning of lower limbs has been recommended.

Shade and ornamental trees can be protected by spraying the trees with a lime sulphur wash at winter strength in the early spring.

(Herrick, G. W., The Larch Case Bearer, Cornell University Bulletin, No. 322;—1912)

(Peirson, H. B., Larch in Maine Threatened by Insect Depredation, Am. For. Mag. Vol. 28, No. 347, P. 666;—1922)

### **Larch Lappet Moth**

*Tolyte laricis*

This insect is of interest largely on account of its remarkable protective coloration. The larvae are hard to distinguish even when pointed out. They are flat, dull rusty-brown, irregularly spotted with white, and have a series of grayish tufts on either side of the body, harmonizing with the bark.

### **Larch Tip Moth**

*Argyresthia laricella*

This insect has been reported as being injurious to larch near Ottawa. The larvae bore in the terminal twigs, forming a burrow sometimes six inches long. The moths appear in July. These are very small. The fore wings are of a pale metallic golden color. The head and thorax are light yellow.

### **Wooly Larch Aphid**

*Chermes strobilobius*

The wooly larch aphid at times causes the trees to appear as if they had been dusted with flour. The winter is spent in the egg stage, the egg masses being laid at the base of the leaf stalks. The young hatch in May and in June the wooly secretion develops. The life history is somewhat complicated. In

Europe this insect passes part of its existence at the base of young pine buds where it produces galls. In August it migrates to the larch where it lays its eggs.

### Eastern Larch Beetle

*Dendroctonus simplex*

This bark beetle which is about one-quarter of an inch long attacks larch in all conditions being particularly injurious to trees weakened by the sawfly. Its presence in the trees is indicated by resin and red borings on the trunk. The beetle forms longitudinal, winding, variably branched egg tunnels which groove the inner bark and wood surface. The eggs are laid in small groups in these tunnels and the larvae tunnel beneath the bark. Any part of the trunk may be attacked. There is but one generation a year.

Trap trees felled in May or June have proved helpful in curbing outbreaks. Infested trees should be cut between September and May and either the bark stripped off and burned or the logs floated. The presence of the beetles makes the bark strip off easily.

### Other Insect Enemies

A large number of insects are known to feed on Larch. M. W. Blackman and H. H. Stage in New York State College of Forestry Technical Publication Number 10, entitled "Notes on Insects Bred from the Bark and Wood of American Larch" list many insects.

*Porthetria dispar*—Gipsy moth. A defoliator. See insects attacking oak.

*Halisidota caryae*—Hickory tussock moth. A defoliator. See insects attacking hickory.

*Hyphantria cunea*—Fall web worm. A defoliator. See insects attacking ash.

*Hemerocampa leucostigma*—White marked tussock moth. See insects attacking elm.

*Thyridopteryx ephemeraeformis*—Bag worm. See insects attacking arbor vitae.

*Lachnus laricifex*—Larch aphid. A brown white-marked aphid.

*Cryptogus atomus*—Slender brown to black bark beetle.  
Secondary.

*Polygraphus rufipennis*—Stout black bark beetle.

*Hylurgops pinifex*—Tunnels usually at base of tree, often  
below surface of ground. Secondary.

*Trypodendron bivittatum*—A very common specie of bark  
beetle.

*Orthotomicus caelatus*—Important secondary enemy work-  
ing in the thicker bark at base of  
trunk.

*Phymatodes dimidiatus*—A round-headed borer mining  
beneath the bark.

## INSECTS ATTACKING LOCUST

Although the locust is not native to Maine, both the Honey and Black Locust have been planted to a considerable extent, and in the southern part of the State have become naturalized. There are many lepidopterous larvae that feed on locust, at times several species may be found feeding on the same tree. Only a few of the most common pests of locust will be listed.

### Locust Leaf Beetle

*Chalepus dorsalis*

The locust leaf beetle is slightly less than one-quarter of an inch long and about one-eighth of an inch wide, hard-shelled and flat. The antennae, head, legs, and the central portion of the wing covers are shiny black as is also the underside of the beetle. The thorax and outer portions of the wing covers are orange-red. There are four prominent ridges on each wing cover. In the spring the beetles eat irregular holes in the leaves and later lay their thin flat oval eggs shingle fashion on the underside of the leaves. The larvae are yellowish-white with true legs. The head, thoracic shield and anal shield are jet black. These larvae mine areas about the size of a dime within the tissues of the leaf. Houser reports that in Ohio a second generation appears in August. The winter is spent by the adults in crevices of the bark. This insect attacks principally the black locust. Ornaments can be protected by spraying them with arsenate of lead at the rate of two pounds of the powder to fifty gallons of water.

(Houser, J. S., Bul. No. 332, Ohio Agr. Exp. Sta., Pp. 231-236;—1918)



**Red-footed Flea Beetle***Crepidodera rufipes*

A very small beetle hardly one-eighth of an inch long, at times becomes very numerous on locust foliage in the spring. The head, antennae, legs, and prothorax are brick red, the wings bluish in color.

**Locust Borer***Cyllene robiniae*

The black locust is very commonly attacked by a borer which leaves ugly scars on the trunks, weakens the trees, and often kills them. The adult beetle is one of the prettiest that we have. It is about three-fourths of an inch long, slender, general color velvety-black, beautifully marked with bright yellow lines extending crosswise on the wing covers. The antennae are about half the length of the body. The beetles appear in September at the same time that the golden rod is in bloom. The snow-white elongate eggs are laid in crevices of the bark and may be seen with the naked eye. They may be laid either singly or in clusters. The larvae bore into the soft inner tissues of the outer bark where they form a small oval cavity in which the winter is spent. In the spring the larvae bore into the heartwood, at times literally riddling the wood, weakening the trees so that they are easily broken over by wind.

Investigations by Craighead showed that the beetles will only lay their eggs on trunks of locust that are in the sunlight and have rough bark. Trees under one and one-half inches in diameter are free from injury and those over six inches in diameter are rarely attacked. He suggests keeping the stands dense so that the trunks will remain shaded. Undergrowth should be encouraged. Infested trees should be cut and burned in the winter.

(Craighead, F. C., U. S. D. A. Bul. 787 Protection from the Locust Borer;—1919)

**Locust Twig Borer***Ecdytolopha insiticiiana*

Swellings on locust twigs will often be found to be caused by a pale yellowish-white caterpillar with a dark brown head. The moths appear in the late fall. They have a wing expanse of three-fourths of an inch. The fore wings are dark ashy-brown with a dull pinkish-white patch on the outer edge. The insect attacks the black or yellow locust.

## Other Insect Enemies

*Epargyreus tityrus*—Locust leaf folder. A pale green caterpillar, with a red head and neck, which draws the leaves together feeding at night during July.

*Hemerocampa leucostigma*—White marked tussock moth. Defoliator. See insects attacking elm.

*Malacosoma disstria*—Forest tent caterpillar. Defoliator. See insects attacking birch.

*Datana integerrima*—Walnut datana. Defoliator.

*Basilona imperialis*—Imperial moth. Defoliator.

*Catocala nubilis*—Catocala. Defoliator.

*Hyphantria cunea*—Fall web worm. Defoliator. See insects attacking ash.

*Automeris io*—Io caterpillar. Defoliator. See insects attacking cherry.

*Gracillaria robiniella*—Locust leaf miner. Mines upper side of leaf

*Chionaspis gleditsiae*—Honey locust scale. Small dark gray scale.

*Eudermes picipes*—Borer mining beneath bark.

*Eburia quadrigeminata*—Borer mining in heartwood.

## INSECTS ATTACKING MAPLE

Six species of maple are found growing in Maine—the sugar, silver, red, striped, mountain, and ash-leaved. The first three named are of considerable economic importance and occur in great quantities. The maples are attacked by a large number of different insect pests, only the most common of which will be considered.

### Green Striped Mapleworm

*Anisota rubicunda*

The soft maples are at times heavily infested with this insect and large outbreaks have occurred in New England. Early in July the wooly-bodied moths, having a wing expanse of about two inches, are at times very abundant. The general color of the moth is a creamy-yellow. The fore wings are of a delicate rose tint, marked with a transverse creamy bar. The

hind wings are similarly marked, the outer third of the wing being rose-colored and the inner two thirds cream-colored. The female lays approximately one hundred and fifty pale green, slightly flattened eggs loosely on the underside of the leaves. The eggs hatch in about ten days. At first the young caterpillars feed in rows, but later spread over the foliage. The larvae are pale yellowish-green, striped lengthwise with dark green. There is a pair of black horns just back of the head. Along the sides and rear of the body are black pegs. When full grown the larvae are about two inches long. Apparently there is but one generation a year in northern New England, but further south there are two or three generations each year.

(Howard, L. O. & Chittenden, F. H., U.S.D.A., Bur. of Ent., Circ. No. 110;—1909)

### **Antlered Maple Caterpillar**

*Heterocampa guttivitta*

Serious outbreaks of this insect have repeatedly occurred on the beech and maple in several parts of New England. In Maine large areas near Fryeburg have been defoliated. The moths usually appear the first of June. These are brownish-gray. The front wings are crossed by indistinct darker lines. They have a wing expanse of about two inches. The pale green eggs are laid singly on the leaves and hatch in about nine days. The larvae, as they mature, change in color from a pinkish hue to a green. They bear nine pairs of black horns, the first pair of which, situated just back of the head, are the longest, and are branched like antlers. They feed for about five weeks and then—the latter part of July—pupate in the leaf mold, the moths emerging the following spring.

This insect has a large number of parasitic enemies and is one of the most striking examples we have of the value of parasites in checking insect outbreaks.

(Collins, C.W., Journal Agr. Research, Vol.32, No. 7, Pp. 689-699;—1926)

### **Green Maple Worm**

*Xylina antennata*

A light green, white-marked caterpillar, about two inches long when full grown, sometimes appears in immense numbers in the spring, defoliating soft maple and ash. The latter part

of June the larvae pupate in the ground. Some of the moths emerge in the fall, others apparently remaining in the pupal stage until the following spring.

### Maple Leaf Cutter

*Paraclemensia acerifoliella*

This insect is sometimes known as the maple case bearer. Early in the spring the small steel-blue moths appear. A close examination shows the under wing scales to be a deep purple-blue overlaid with peacock green. The head is orange colored, the antennae black. The eggs are deposited on the leaves and upon hatching the young larvae start excavating mines. In about two weeks they emerge, and cut four pieces out of the leaf with which they form a small oval case. From the protection of this case the larvae skeletonize the leaf in a crescent-shaped area and then move on to another place. The skeletonized portions of the leaf often fall out. The larvae feed from July until September, at which time they pupate in the leaf litter. It has been suggested that careful burning of the leaf litter will destroy the insects. The leaf litter should be raked away from the base of the trees so that the trunks will not be injured. Such a procedure can be carried on in the case of shade or ornamental trees.

(Swaine, J. M. & Hutchings, C. B., Can., Dept. Agri., Bul. No. 63, n. s., Pp. 11-12;—1926)

### Dog-day Cicadas or Harvest Flies

*Tibicen linnei*

In the latter part of the summer a rather shrill buzzing in the tree tops often attracts considerable attention, and at times the large heavy fly-like insect may be found on the ground where it has fallen from the tree. The insect in question has a wide blunt head with prominent eyes on the outer angle, and three smaller eyes or ocelli between these compound eyes. There are four large membranous wings. The body color is black and olive green, more or less powdered with white beneath. The adult commonly measures about two inches in length.

The eggs are laid in twigs of hardwood trees. The female skillfully constructs a double nest in the twig with her long curved ovipositor. The double nests have but a single opening and the eggs are laid in these chambers. The young nymph



hatch in about six weeks, in the case of one species. These drop to the ground, tunnel through the earth, and start sucking the juices from the roots. Here they are supposed to remain for two years. In the case of the seventeen year locust, which is slightly smaller and of a black and orange color, the nymphs remain feeding on the roots for seventeen years. The emergence usually takes place in the early evening, when swarms of the cicadas emerge.

The cicada has one of the most complicated sound organs found in the entire animal kingdom. As a rule only the males can sing, the females being mute. Large plates on the side of the hind border of the thorax and overlapping the basal part of the abdomen cover two cavities within which is a vibrating membrane. An air sac behind this membrane causes it to vibrate. The outer plate serves to protect the delicate organs and aids in decreasing and increasing the volume of the sound.

(Marlatt, C. L., U.S.D.A. Bur. of Ent. Bul. 71, The Periodical Cicada;—1907)

### Cottony Maple Scale

*Pulvinaria vitis*

A brown scale which is not conspicuous until midsummer when the white cottony egg masses are secreted at the end of the body. The eggs hatch in a few days and the young settle upon the twigs and underside of the leaves where they feed by sucking the plant juices. In the fall the females migrate to the twigs where they remain unchanged during the winter. In the spring these young scales grow rapidly.

### Norway Maple Aphis

*Periphyllus lyropictus*

Frequently a yellowish-green, brown-marked aphid becomes very abundant on the underside of Norway maple leaves. Large amounts of honey-dew, which is a sticky secretion formed by the aphids, collects on the leaves and in the case of shade trees on the sidewalks, beneath. The aphids are particularly abundant in seasons of little rainfall. These insects are prolific breeders, and pass through many generations during the season so that they multiply very rapidly. Ants frequently feed on the honey-dew.

The aphids can be destroyed by spraying the underside of the leaves with nicotine sulphate mixed with a soap solution or

by merely playing a fairly strong stream from a garden hose on the foliage. The aphids are very frail and are easily killed.

### Galls

Galls may be termed as abnormal plant growths and are found in many fanciful shapes on all parts of the tree. Probably the most noticed ones in the case of maple are those found on the leaves. It is interesting to note that each type of gall is made by a specific insect or mite. At times the leaves are heavily infested with these gall-like growths. For a complete list of the galls Doctor Felt's report should be referred to.

A. Leaves appear as if coated with a sugar-like substance which is green at first, later turning red. Caused by a species of *Eriophyes*. (Mites).

B. Circular reddish, yellow margined spots on red maple known as the ocellate maple leaf gall. This is caused by *Cecidomyia ocellaris*.

C. Bladder-like green or reddish leaf galls. Often very abundant on upper surface of red maple leaves. The bladder maple gall caused by a mite, *Phyllocoptes quadripes*.

(Felt, E. P., Key to American Insect Galls, 71st Ann. Report, N.Y. State Museum;—1917)

### Sugar Maple Borer

*Plagionotus speciosus*

In Maine this is probably the most serious enemy that the sugar maple has and is so prevalent and destructive in many parts of the State, it seems unadvisable to plant this tree. Infected trees are easily spotted by the presence of dead limbs, ragged scars on the larger limbs and trunk, and oval holes and frass or 'sawdust' left by the insect.

The adult is a handsome beetle about an inch long. The beetle is stout, with short heavy black antennae. The general color is black, brilliantly marked with yellow. The beetles appear in July and August and lay their eggs on the larger limbs and trunk. The larvae are whitish with powerful brown mouth parts. The first year they mine beneath the bark and the second year bore obliquely up and into the heartwood. This makes a two year life cycle.

Control of this insect under forest conditions has not been worked out, but it appears that the beetle prefers open grown

trees so that any scheme of management that keeps the stands dense is probably preferable. Heavily infested trees should be cut and burned before June. Under shade tree conditions there are several methods that can be used, such as forcing a flexible wire into the burrow killing the borer, or by injecting carbon bisulphide into the holes from which fresh frass or 'sawdust' is being forced out. These holes should then be plugged with putty.

### Pigeon Tremex

*Tremex columba*

A large beautiful four winged wasp-like insect with a wing expanse of about two and one-half inches, general body color brown with yellow markings on the abdomen, attacks diseased or dead trees. The female Tremex has appendages on the tip of her abdomen with which she bores holes into the solid wood to lay her eggs in. When full grown the larvae are two inches long.

The most interesting thing in connection with this insect is a magnificent wasp-like insect which deposits its eggs in the burrows of the pigeon tremex. The larvae are parasitic upon the larvae of the Tremex. The adult's body is about one and one-half inches long and the ovipositor or thread-like appendages on the end of the abdomen are from three to four inches long. This insect bears the name *Thalessa lunator*.

### Carpenter Worm

*Prionoxystus robiniae*

Early in July a magnificent moth, gray in color, except for the fore part of the hind wings which is nearly black, and with a wing expanse of nearly three inches, may be seen flying around the trunks of maple. The moths lay from three hundred to four hundred eggs near wounds or scars on the bark. The young larvae bore into the tree and at times completely riddle the trunks. When full grown the larva is two and one-half inches long, white with a pinkish tinge above, greenish below. The head is dark brown and scattered along the body are brownish tubercles with rather long fine hairs. The larvae at first feed on the soft inner bark, later going into the sapwood and heartwood. The life history is supposed to last three years.

Infested trees should be cut and burned before June.

## Maple Sesian

*Synanthedon acerni*

Gall-like cankers on the limbs of maple are often caused by the larvae of the maple sesian. This is a wasp-like moth with clear membranous wings, tinged with yellow and red. The moth has a red head and a red fan-like plume at the tip of the abdomen. The thorax and legs are yellow. The wing expanse is about one inch.

The moths appear in early summer and lay their eggs on the rough bark, usually near wounds. The eggs hatch in a few days, and the larvae feed on the bark and sapwood. Characteristic brown castings are thrown out on the wounds. The larvae pupate in the burrows. The chrysalids wiggle out until the frontal half of the body extends from the burrow.

As this insect prefers roughened areas on the bark to lay its eggs, trees should be protected from mechanical injury. In the case of shade trees, it is practical to dig out and destroy the larvae.

## Other Insect Enemies

*Datana ministra*—Yellow-necked caterpillar. Black, striped with narrow yellow longitudinal lines and bright yellow neck. Feed in clusters. Moths reddish-brown, two inch wing expanse. Eggs laid in June.

*Malacosoma disstria*—Forest tent caterpillar. See insects attacking birch.

*Hemerocampa leucostigma*—White marked tussock moth. See insects attacking elm.

*Samia cecropia*—Cecropia moth. See insects attacking cherry.

*Alsophila pometaria*—Fall canker worm. See insects attacking ash.

*Paleacrita vernata*—Spring canker worm. See insects attacking elm.

*Basilona imperialis*—Imperial moth.

*Automeris io*—Io moth. See insects attacking cherry.

*Diapheromera femorata*—Walking stick. See insects attacking basswood.



*Porthetria dispar*—Gipsy moth. See insects attacking oak.  
*Euproctis chrysorrhoea*—Brown tail moth. See insects attacking oak.

*Zeuzera pyrina*—Leopard moth. Wood borer. See insects attacking oak.

*Chrysobothris femorata*—Flattened galleries in sapwood.

*Dicerca divaricata*—Flatheaded borer.

*Xylotrechus aceris*—Causes gall on small red maple trunks.  
Long horned beetle.

*Pteroclyon mali*—Bark beetle.

*Anisandrus obesus*—Bark beetle.

## INSECTS ATTACKING OAK

Seven species of oak occur in Maine, largely in the southern part of the State. The oak probably has a greater array of insect enemies than any other hardwood tree.

### Gipsy Moth

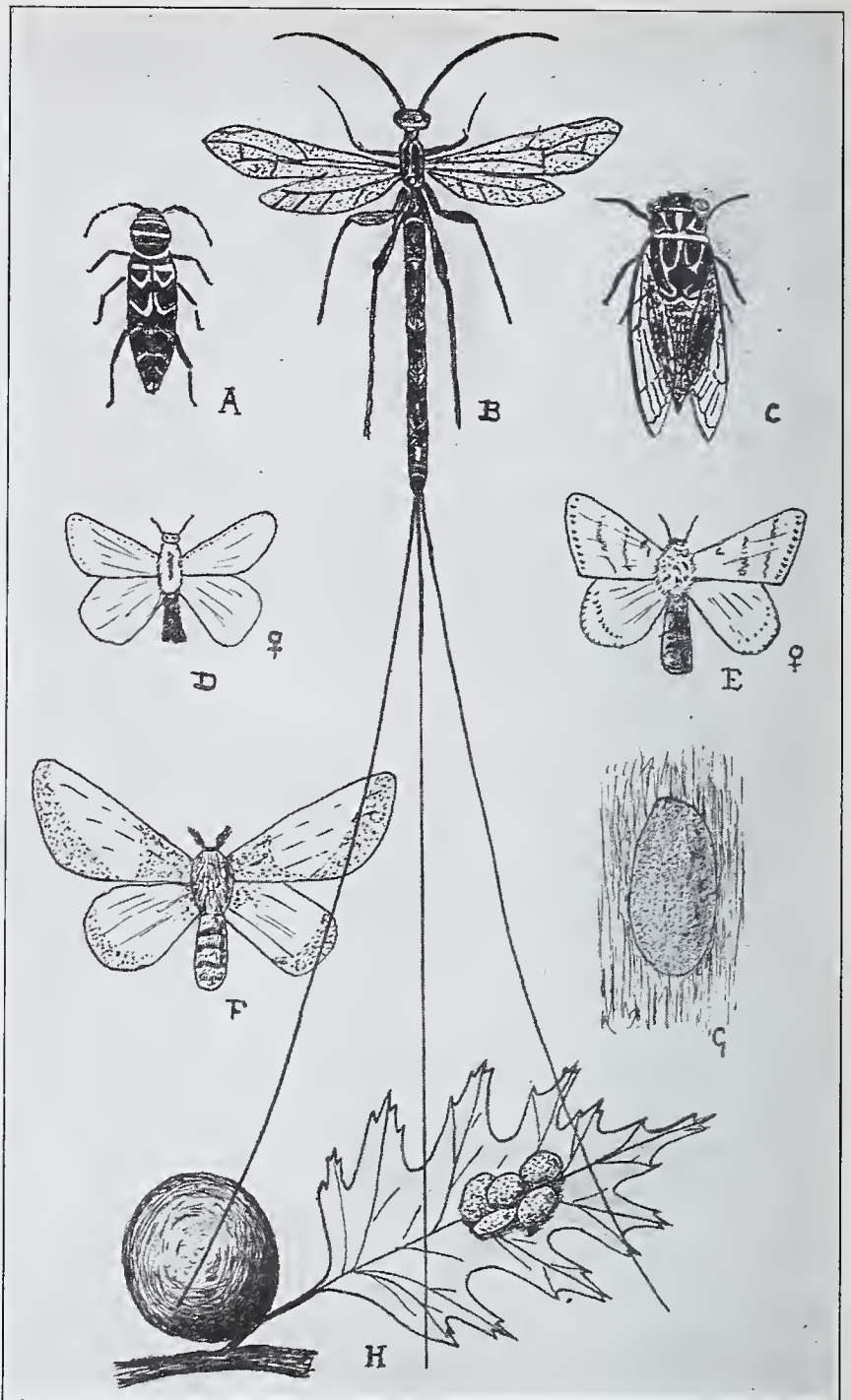
*Porthetria dispar*

The gipsy moth was brought into this country from Europe in 1869 and by 1889 had become very abundant.

The male moth is dark brown in color, with black wavy lines on the wings. The female is white with a few black markings on the wings. The abdomen is yellowish-brown, and is so heavy that she is unable to fly. In July, clusters, usually containing four hundred or more eggs covered with buff colored hairs, are laid. These egg clusters may be found in a great variety of places, but usually close to the food plant upon which the insect has been feeding. Oftentimes the underside of large limbs will be found literally plastered with egg masses.

The larvae hatch the following spring. These are brownish caterpillars with a double row of blue and reddish spots—the anterior ones being blue, the posterior red. The larvae feed on a large number of forest trees particularly the hardwoods. To some extent conifers are injured as will be described under 'Insects Attacking Pine.' Large numbers of trees weakened by the gipsy moth larvae are later destroyed by wood boring insects.

The United State Bureau of Entomology has been carrying on one of the most remarkable pieces of insect control work



A. Adult Locust Borer. B. Long-tailed Thalesa. C. Dog-day Cicada ( $\frac{1}{2}$  natural size). D. Brown-tail Moth. ( $\frac{2}{3}$  natural size). E. Gipsy Moth ( $\frac{1}{2}$  natural size). F. Adult Green Striped Maple Worm ( $\frac{2}{3}$  natural size). G. Gipsy Moth Egg Mass. H. Oak Galls.

ever undertaken. Large numbers of parasites from different parts of the world have been imported and liberated throughout the infested area, and these have done a remarkable work in holding the insect in check. As the insect is spread largely by the agency of man, quarantines have been placed upon plants or parts thereof liable to harbor principally the eggs of the insect. Roadside trees are sprayed with arsenate of lead to lessen the danger of caterpillars dropping on to automobiles and being carried into uninfested regions. Egg masses are destroyed by treating them with creosote.

(Clement, G. E., Control of the Gipsy Moth by Forest Management, U. S. D. A., Bul. 484;—1917)

### Brown Tail Moth

### *Euproctis chrysorrhoea*

This European pest was first found in this country in 1897, although it was probably brought in several seasons previous on imported nursery stock. The moths are pure white except for the tip of the abdomen which is covered with dark brown hairs. The egg clusters, containing from two hundred to three hundred eggs, are laid in July on the underside of the leaves. The eggs hatch about the middle of August and the young larvae start feeding on the epidermis of the leaf. After one or two molts they construct a winter nest made by drawing together the terminal leaves and fastening them with silk. Here they remain all winter. In the spring, the larvae leave the nest as soon as the buds open, feeding first on the bud scales, then on the new leaflets. They become full grown about the middle of June. At this time they are slightly over one inch long. The head is pale brown mottled with darker brown. The body is dark brown to black with dull orange or gray spots on the surface. Long reddish-brown, finely barbed hairs arise from all the tubercles. The hairs are poisonous. The caterpillars feed on many hardwood trees,—oak, elm and maple being favored. Conifers are never attacked.

Other than spraying the trees with arsenate of lead, in the spring, webs should be cut off from the trees during the winter and burned.

(Burgess, A. F., U. S. D. A., F. B. No. 1335;—1923)

**Pale Tussock Moth***Halisidota tessellaris*

During the fall of the year caterpillars of the pale tussock moth may be found feeding, usually in company with other caterpillars, on the foliage of hardwood trees. These larvae are grayish brown in color, with a sprinkling of black. Numerous tussocks of white and buff-colored hairs occur on the body. Just behind the head are four long tan pencils of hairs.

**Leopard Moth***Zeuzera pyrina*

This European insect has gained a strong foot-hold in New England and has become a particularly serious menace to shade trees. Conifers are not attacked, but practically all the hardwood trees are subject to injury and are frequently killed by the girdling effects of the borer.

During June or July, the moths emerge. The wings are white, semi-transparent and thickly coated with steel-blue spots. The thorax has six steel-blue spots on the upper surface. The abdomen is lightly covered with grayish scales. The moth has a wing expanse of about two inches. The female lays her orange-yellow to salmon colored eggs, either singly or in small groups in crevices of rough bark. As many as eight hundred eggs may be laid by a single moth.

The larvae are of a yellowish-white to pink color. Each abdominal segment has twelve brown tubercles from which one or two long hairs protrude. The head, thorax and anal plates are sparsely covered with hairs.

Upon hatching, the young larvae may crawl a distance of eighty feet or more to the twigs which they enter, boring into the woody tissue. As the twig becomes too small for them, they emerge and enter a larger branch. As they become still larger they may enter and completely girdle the trunk.

Infested limbs should be cut off and burned. As many as a thousand larvae have been taken from five trees in this manner.

(Chapman, J. W., Contrib. No. 48, Ent. Lab., Bussey Inst., Harvard University;—1911)

**Oak Galls**

A great number of galls are found on the different species of oak. These galls or swellings are found on the roots, decay-



ing bark, branches, twigs, leaf buds, leaves, catkins, and fruit, and are of a great number of sizes and shapes. Each type though is caused by a specific organism, for the most part insects. These have been admirably worked out by Doctor E. P. Felt in his 'Key to American Insect Galls' (Seventy-first Annual Report of the New York State Museum). Cetarain oak galls are used for dying, tanning, and in the manufacture of ink.

### Maple & Oak Twig Pruner

*Hypermallus villosus*

In the fall of the year the ground beneath the oak trees may be strewn with hollowed-out cut-off twigs. The fallen twigs appear as if they had been severed with a knife. The maple and oak twig pruner, which causes this injury, is one of the most interesting tree insects which we have, and is quite common in Maine. The adult beetle is about one-half inch long, very narrow, light to dark brown, mottled with gray.

According to Felt, the beetles deposit their eggs in July on the smaller twigs. Upon hatching, the young larvae feed first just beneath the bark, later boring into the center of the twig making a somewhat oval channel. In late summer the larva cuts through the wood fibre almost to the bark, plugs the end of its burrow with frass and then waits for the fall winds to break the twig off. The larva pupates within this fallen twig and the adult emerges the following spring.

The insect is easily controlled by picking up and burning the fallen twigs before spring.

(Felt, E. P., Manual of Tree & Shrub Insects, Pp. 42-43;—1924)

### Twig Girdler

*Oncideres cingulatus*

In the early fall, usually in September, a rather stout, reddish-brown to clay-yellow beetle about one-half inch long, may be found flying about oaks. The beetle has dark brown markings at the base of the antennae, and at the base and near the middle of the wing covers. Eggs are deposited just beneath the bark of the twigs and the beetle then proceeds to girdle the twig below the place where the eggs were laid. The twig is thus killed and most of them are later broken off by the wind. The larvae pass the winter in the fallen twigs, and the coming

summer feed within them. Some of the larvae may feed through two seasons before pupating.

Girdled twigs should be collected and burned.

### **Lesser Oak Carpenter Worm**      *Prionoxystus macmurtrei*

The female moth has gray wings crossed by several black wavy lines. The male moth is clear winged. The larvae bore deep into the heartwood of red oak, at times killing the trees.

### **Other Insect Enemies**

*Malacosoma disstria*—Forest tent caterpillar. See insects attacking birch.

*Anisota rubicunda*—Green striped maple worm. See insects attacking maple.

*Alsophila pometaria*—Fall canker worm. See insects attacking ash.

*Paleacrita vernata*—Spring canker worm. See insects attacking elm.

*Datana ministra*—Yellow necked datana.

*Hemerocampa leucostigma*—White marked tussock moth. See insects attacking elm.

*Erranis tiliaria*—Lime tree winter moth. See insects attacking basswood.

*Anisota senatoria*—Yellow striped oak caterpillar. Black, yellow striped caterpillars. Two long black horns on second segment. June and July.

*Phyllonorycter hamadryella*—Oak leaf miner. Irregular white blotch-like mines in fall.

*Pulvinaria vitis*—Cottony maple scale. See insects attacking maple.

*Asterolecanium variolosum*—Golden oak scale. Minute rounded golden scales in small pits on oak twigs.

*Balaninus rectus*—Acorn weevil. Causing wormy acorns. Beak of female nearly twice length of body.

*Phymatodes variabilis*—Variable oak borer. Red prothorax and bluish wing covers. Mines the inner bark of dead and dying oak, also injures tan bark.

*Ithycerus noveboracensis*—Large grayish weevil. Feeds on buds and twigs causing them to break off.

*Lepturges querci*—Small beetle. Breeds in limbs.

*Agrilus bilineatus*—Two-lined chestnut borer. See insects attacking chestnut.

*Prionoxystus robiniae*—Carpenter worm. See insects attacking maple.

## INSECTS ATTACKING PINE

There are four species of pine growing native in Maine—the white, red, pitch, and jack. The first two of these are of great economic importance. White pine is found in large bodies throughout the State, particularly in the southern third. The insects which are found attacking pine are legion and only the most common can be mentioned in this paper.

### Sawflies

Three species of sawflies are frequently found attacking pine and at times destroying large stands of it. The term sawfly comes from a sawlike appendage on the tip of the abdomen of the adult fly. This saw is used in cutting slits in the plant tissue in which the eggs are laid. In the case of the three sawflies about to be mentioned, the female cuts the slits in the needles and then deposits eggs singly in these slits. The larvae all have the characteristic habit of elevating both ends of the body when disturbed.

#### A. Imported Pine Sawfly

*Diprion simile*

In Europe this is a serious pest of pine, causing a tremendous amount of damage. It was imported into this country in 1914 from which time it has spread rather rapidly. The adult sawfly appears in the early spring. The female is about three-eighths of an inch long. The head is black, with feathery antennae. The thorax, abdomen, and legs are yellow with black. The eggs are white at first, later appearing greenish and are for the most part laid in the last year's needles. As the season progresses, some may be laid in the current year's needles. The larvae feed on the foliage. When full grown, they are about one inch long. The head is black, the body greenish-yellow with a mid

dorsal, double brown stripe, and on either side a broken yellow and brown stripe. The winter is spent in thick cocoons in the soil beneath the trees. White, red, and pitch pines are fed upon.

(Middleton, W., U. S. D. A., Bul. 1182, The Imported Pine Sawfly;—1923)

### **B. Leconte's Sawfly**

*Neodiprion lecontei*

Clusters of red-headed, dirty yellowish, black-spotted caterpillars may be found feeding on pine in midsummer and again in the fall, there being two broods. Altho the larvae are foliage feeders, they may at times feed on the tender bark of young twigs. When full grown they drop to the ground and a few inches beneath the surface spin reddish-brown tough papery cocoons. The adult male is black with reddish-yellow legs, and feathery antennae. In the case of the female the head and first two thoracic segments are reddish-brown, the rest of the body being black.

(Middleton, W., U. S. D. A. Farmer's Bul. No. 1259;—1922)

### **C. Abbott's Pine Sawfly**

*Neodiprion pinetum*

Yellowish-white caterpillars, with black heads and four longitudinal rows of black spots, may be found feeding in midsummer on pitch and white pine. In some sections there is probably a second brood in the fall. When full grown the larvae crawl to the ground and pupate under rubbish at the base of the tree, where the winter is spent. The adult male has a wing spread of about one-half inch. The body is black, except for the tip of the abdomen and the underside which are yellow. The female is slightly larger, having a wing spread of about two-thirds of an inch. The body is honey-yellow, the abdomen being marked with yellow.

### **Pine Tube Builder**

*Eulia pinatubana*

The needles of white pine are frequently webbed together in tubes by a small caterpillar with a light brown head and olive-green body. Usually there are from twelve to fifteen needles to a tube. The caterpillar feeds within this tube, chewing the needles off until they are about an inch long. The tubes may be deserted and others started. Pupation takes



place within the tube where the winter is spent. The moths have a wing spread of about one-half inch. The head, thorax, and forewings are a dull rust red, the latter with two oblique pale bands. The hind wings and upper side of the abdomen are silky gray. In the case of trees under six feet in height the tops may be entirely defoliated in the fall. Control measures are rarely necessary, an arsenate spray being the only known means of combatting this insect.

(Peirson, H. B., Maine Forest Service Bul. No. 1, P. 40;—1923)

### Mound Building Ants

*Formica exsectoides*

Outstanding amongst our forest insects in system of work and intelligence shown, is the mound building ant. The large mounds, at times being of tremendous size, are a common sight throughout New England. The ants in these mounds may destroy all the vegetation around the nests for a distance of twenty feet so that they are almost invariably found in openings. Young pine trees are killed up to an age of about ten



Mounds of *Formica exsectoides* showing barren area around them.

years. The ants use a unique method of killing the trees. Formic acid is injected by them into the tissues of the main stem a short distance above the ground. The acid coagulates the cell contents, thus preventing the downward flow of the sap. The lesion appears superficially like a fungus canker. During the summer months as the nests become crowded some of the ants may swarm and start a new colony.

It is useless to plant pine within fifteen feet of these mounds, which are commonly three feet high and six feet or more in diameter. The colonies are not easily destroyed as the queens, or mothers, live deep down in the nest often five or six feet below the surface of the ground, and unless these are killed, the colony will continue to live. The use of carbon bisulfide has, however, proved very satisfactory in destroying the colonies. These should be treated in the spring or fall when the ants are in the nests. Five or six holes should be punched deep into the nest and from a pound to a pound and a half of the carbon bisulfide per nest poured into these holes, and the earth tamped down hard to prevent the escape of the gas. Small nests are, of course, much more easily destroyed than the larger ones so that it pays to treat the nests before they become of large size.

(Peirson, H. B., Mound Building Ants in Forest Plantations, Jour. of For., Vol. 20, No. 4, Pp. 1-12;—1922)

## Gipsy Moth

*Porthetria dispar*

In 1922 a large plantation of white pine in southern Maine was attacked by first and second stage gipsy moth larvae. The young caterpillars which had been blown in great numbers onto the plantation from surrounding birches, were feeding on the epidermis of the main stem and laterals of the young pine, entirely girdling them. The larvae are covered with both long and short hairs, which aid materially in making them buoyant so that they are easily blown by the wind. This plantation would probably have been entirely destroyed if it had not been sprayed with arsenate of lead.

In mixed stands of pine and hardwood the pine is often severely damaged by migrating caterpillars. The life history of the gipsy moth with description of stages is described under 'Insects Attacking Oak.'

## White Pine Aphid

*Lachnus strobi*

Pines are at times covered with swarms of brownish-black aphids. These insects, if present in great numbers, may cause the death of small trees. There are many generations a year and during dry seasons they multiply very rapidly. The aphids are usually tended by ants which feed on honey-dew,

a secretion given off by them. This secretion very often coats the needles, limbs, and trunk and a sooty fungus which grows on it gives the trees a blackened appearance. In the fall the females lay their oval shaped eggs end to end usually in lines of five or six on the needles. When first laid the eggs are pale yellow, in a few hours they change to a dark orange and later to a jet black.

(Peirson, H. B., Psyche, Vol. 27, Nos. 2-3, Pp. 62-63;—1920)

### **Pine Bark Aphid**

*Chermes pinicorticis*

The pine bark aphid or wooly aphid as it is often called is quite common on the trunks and limbs of white pine. The insect appears as patches of white flocculent cottony material beneath which can be found the dark reddish-brown aphids. In the fall the eggs are deposited in downy balls near the base of the needles. Here the winter is spent. The eggs hatch about the first of June and the young migrate to the tender bark of young growth. There are several generations each year. Unthrifty trees are most liable to attack. At times the trunks of large trees may be entirely covered with the wooly secretions and such trees should be cut and either burned or salvaged. Ornamentals can be protected by spraying with nicotine sulphate, or by simply turning a strong stream from a garden hose on the infested parts.

### **Pine Leaf Miner**

*Paralechia pinifoliella*

This is probably the most common of our pine leaf miners. The small cylindrical yellowish-brown larvae mine in the needles during June causing the tips to turn brown. The moths are a deep yellow-brown with gray and white markings.

### **Pine Leaf Scale**

*Chionaspis pinifoliae*

The needles of spruce and pine are attacked by a waxy white scale insect which becomes full grown about the first of August. The feeding of the insect causes the foliage to turn brown. The winter is spent as purplish eggs beneath the scales. Infested ornamentals should be sprayed in the early spring with miscible oil at a dilution of one to sixteen.

**European Pine Shoot Moth***Evetria buoliana*

This insect is considered a serious pest in European forests and has gained a foothold in parts of New England. The small orange-colored silvery marked moths fly during June and July, laying their eggs on the terminal buds. The small, black-headed, brown-bodied larvae feed within the buds, destroying large numbers of them. The new shoots are also injured and these have a tendency to bend downward, outward, and then up, causing a disfiguration of the tree similar to a bayonet in shape. In plantations, infested buds and twigs should be pruned off and burned.

(Busck, August, The European Shoot Moth, U. S. D. A., Bul. No. 170;—1915)

**Pine Webworm***Benta malanogrammos*

Yellowish-brown larvae, pale beneath, forming nests two to three inches long filled with brown pellets of excrement. Larvae feed on the foliage.

**False Pine Webworm***Lyda sp.*

Brown to greenish sawfly larvae with conspicuous antennae and filaments at other end of body, which give them a two-headed appearance.

**Pitch Twig Moth***Rhyacionia comstockiana*

The twigs of hard pine, particularly the pitch pine, are hollowed out by the larvae of the pitch twig moth. The work of these larvae causes considerable pitch to exude which forms masses in which the larvae pupate. The moths have a wing spread of three-fourths of an inch. The fore wings are light orange with a grayish-brown fringe, the hind wings are a pale gray brown.

**Pine Moth***Rhyacionia frustrana*

The pale brown larvae of this moth eat into the heart of the buds and then burrow down for a distance of about two inches. The injury is easily spotted by the short brown needles and exuding pitch. The fore wings of the pine moth are reddish-brown with transverse bands of silvery-gray. The hind wings are light gray to brown.



**Pitch-mass Borer***Parharmonia pini*

Large brownish pitch masses usually just beneath a branch or near the border of the wounds. Larvae excavate winding tunnels in sapwood and in May pupate within the pitch masses. The moths emerge in June or July.

**Pine Sheath Miner***Diplosis sp.*

A rather unusual type of defoliation occurred in 1923 on a white pine plantation in northern Maine. The needles on the trees turned brown and then dropped off during midsummer. There was no sign of injury to the needles, but a close examination of the needle sheaths showed the presence of minute orange colored larvae which were feeding at the base of the needles, causing them to turn brown. The insects belong to the family Itonididae and probably to the genus *Diplosis*. The adult is a minute black fly.

**Pine Spittle Bug***Aphrophora parallela*

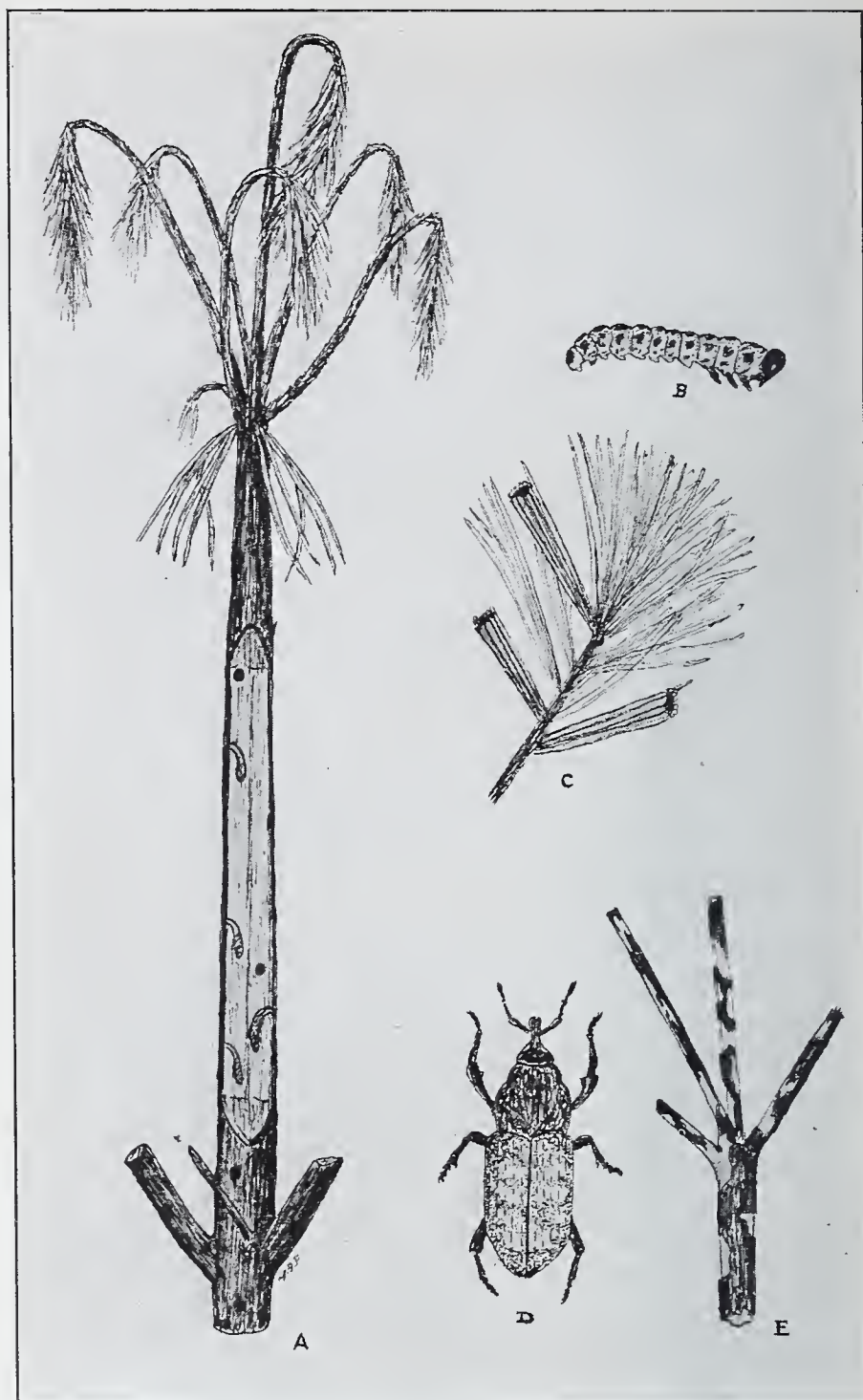
Hard pine is at times attacked by spittle bugs both of this species and others. The insects are found under masses of froth-like spittle which appear on new growth twigs.

**Strawberry Crown Girdler***Brachyrhinus ovatus*

The small white grub-like larvae of this weevil may at times do considerable damage to pine and spruce seedlings. The larvae girdle the stems at from one to three inches below the surface of the ground. There is a large range of food plants including red and Scotch pine and several species of spruce. The larvae pupate in the ground during early June at a depth of from one and a half to three inches, and may be destroyed at this time by plowing and harrowing. The adults can be trapped under boards, weed piles, burlap, etc., particularly during hot dry weather. The adults are active only at night. The larvae live for from ten months to one year.

**White Grubs***Lachnosterna spp.*

Forest nurseries are very often severely damaged by the larvae of May beetles or June bugs as they are commonly called. Normally the larvae feed upon the roots of grass and



### WHITE PINE INSECTS

- A. Leader killed by White Pine Weevil showing characteristic drooping of current year's growth, and pupal chambers with exit holes. ( $\frac{1}{3}$  natural size). B. Larva of Leconte's sawfly. C. Work of Pine Tube Moth. ( $\frac{1}{2}$  natural size). D. Adult Pales Weevil. (Enlarged 2x). E. Work of Pales Weevil on pine seedling, showing girdling effect. ( $\frac{1}{3}$  natural size).

are particularly liable to do damage when such land is turned over. The beetles lay their eggs in the ground and the larvae feed in most cases for three seasons, each fall going deep into the ground. In one nursery, an average of four hundred grubs per square yard were found. The adults, appearing the third season, swarm at night to the trees where they feed for a while on the foliage, particularly of oak, ash, and hickory.

J. F. Illingsworth, an Australian entomologist, has obtained remarkable results in control by the use of crude white arsenic, applying eighty pounds per acre. This method of control is based upon the fact that in feeding a large amount of soil passes through the intestinal tracts of the grub. By mixing the arsenic with the soil, when preparing the seed bed, almost perfect control may be expected. No detrimental effect upon plant growth was noticed even when the arsenic was used in excessive amounts. In Maine similarly good results have been obtained. Even after the damage started portions of beds were saved by putting a ring of arsenic around the dying areas to prevent the spread of the grubs.

### White Pine Weevil

*Pissodes strobi*

Undoubtedly the most serious enemy of white pine is the white pine weevil. Other enemies may be locally extremely serious but wherever the white pine grows there the weevil sooner or later almost invariably attacks the terminals of trees growing in the open. The killing of the leader, or terminal, causes the trees to become forked, crooked, and many branched. This spoils the tree for first class lumber purposes, and often materially lengthens the time of rotation for the crop.

The adult is a small reddish-brown beetle about one-quarter of an inch long with small irregular whitish marks on the wing covers. The head is prolonged into a beak. About the first of May or soon after the new growth starts the beetles may be found congregated on the terminals amongst the opening bud clusters.

In southern Maine the adults appear about the first of May and feed to some extent on the terminal buds. The female then starts ovipositing in the previous years leader. A single female may lay over a hundred eggs. The exudation of pitch on the terminal shoots indicates where the eggs have

been laid. These hatch in from six to fourteen days and the young larvae start burrowing down, first in the inner bark, then between the bark and the wood, eating all of the inner bark and cambium. On slow growing trees, they may pass the second and third whorl of branches. The larvae live nearly two months, and about the first of August, pupate in a deep cell made in the wood and lined with fine excelsior-like chips. The pupal stage lasts approximately ten days. Most of the adults emerge by the latter part of August. For the most part the winter is apparently spent in the duff beneath the trees.

The following suggestions for control have been proved feasible. In the first place pine growing under the protection of a hardwood canopy is practically immune to injury. Furthermore, pine growing in dense stands will largely overcome the effects of weeviling due to the fact that the laterals are forced into an upright position. These two points give a clue as to methods of management that will minimize the damage.

The practice of cutting off and burning weeviled tops during June in plantations greatly reduces the loss for the following year. The writer has also obtained excellent results in going thru a plantation as soon as the weevils appear and knocking them off by jarring them into a net. These two methods of control are applicable in the case of valuable plantations.

(Graham, S. A., Cornell Univ. Agr. Exp. Sta., Bul. 449;—1926)

(Peirson, H. B., Harvard Forest Bul. No. 5;—1922)

## **Pales Weevil**

*Hyllobius pales*

The pales weevil, a fairly large black snout beetle, is attracted in large numbers to areas where freshly cut pine stumps, logs, boards, or even slash occur. The beetles are ravenous feeders, chewing the bark off from pine seedlings, girdling and killing them. It is practically useless to start a coniferous nursery or plantation on a pine area that has just been cut. Such an area should not be planted until the third year after cutting.

The beetles emerge from hibernation during May and feed near the place of emergence until about the middle of June when they swarm to an area preferably where a white pine



logging operation has just taken place. On reaching the new breeding place they may feed for two weeks. Eggs are laid in freshly cut logs or stumps. The eggs hatch in about two weeks and the larvae feed for about two months beneath the bark. About the first of September they pupate beneath the bark, emerging as beetles about the last week in September. It is at this time that they feed on the pine seedlings. Most of the feeding is done at night. The winter is spent in the soil.

The burning of slash over the stumps helps to lessen the damage. During the season of 1926 dusting pine stumps and logs with lime sulphur lessened the damage on one plot by fifty percent. Fresh cut pine logs and lumber should not be piled in an area where there are pine seedlings.

(Peirson, H. B., Harvard Forest Bul. No. 3;—1921)

## Round-headed Borers

*Monochamus Spp.*

Three species of *Monochamus* are very injurious to dead and dying pine, particularly to logs left lying in the woods during the summer. These beetles are amongst the largest which we have in New England and are particularly abundant on warm sunshiny days around logging operations. Some feeding is done by the adults on the underside of coniferous twigs causing them to die. This injury shows up as red or brown needles. Eggs are laid in the bark of the trees, the female gnawing an irregular hole in which from one to six eggs are inserted. The larvae feed for from one to three months beneath the bark, packing the space with long fibrous frass. They then enter the wood thru an oval hole, boring thru the sapwood and heartwood, causing a condition known as wormy timber. This greatly depreciates the value of the lumber. In northern Maine the life cycle extends for two years. The antennae of the males is nearly twice as long as the body, whereas that of the females about equals the body length. The larvae are white, robust, legless, with distinct body segments.

A. *Monochamus scutellatus*. A bronzed black beetle about one inch long, attacking pine and spruce.

B. *Monochamus confusor* (*notatus*). A mottled gray and brown beetle about one inch long apparently attacking only white pine.

C. *Monochamus titillator*. A brownish beetle somewhat mottled with gray about three-fourths of an inch long.

Fire or insect killed timber, wind falls, and other dying pine and spruce should be immediately salvaged, if it is to be used for lumber purposes. Peeled logs are immune to injury from these borers. Logs that are not going to be immediately sawed into lumber should be put in water. During 1925 and 1926, the Maine Forest Service has been carrying on experiments in an endeavor to find a practical method of protecting logs left in the woods from borers. Almost perfect protection was obtained by dusting the logs with powdered lime sulphur. Experience showed that the under side of the logs must also be dusted. The application of the lime sulphur to the logs requires very little labor and can be put on by means of a mechanical duster or by throwing it over the logs with a trowel. This should be done either after a rain or while the dew is on the logs so that the powder will stick. The lime sulphur is not a poison, but acts as a repellant, counteracting the attractive odor of the pitch.

(Peirson, H. B., Sixteenth Rept. Maine Forest Commission, P. 50;—1926)

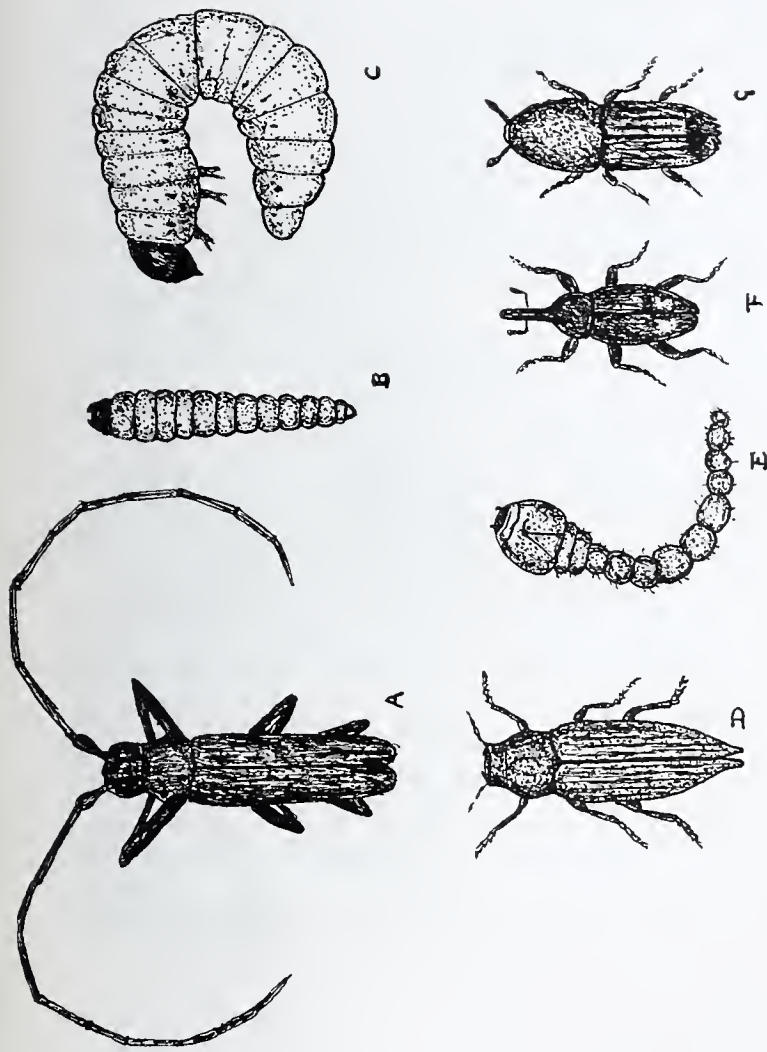
(Webb, J. L., U. S. D. A. Bur. of Ent., Bul. 58, Part 4;—1909)

## Flat-headed Borers

Closely allied with the round-headed borers as destructive to pine and spruce are the buprestids or flat-headed borers. For the most part the adults are bronzed, flat bodied beetles. The larvae are elongated, somewhat flattened grubs. The head is small, but the segments just in back of the head are greatly enlarged and often mistaken for part of the head. The life history and destructive nature of the beetles are very similar to that of the round-headed borers and the same methods of control are advised. The larvae fill their cavities with soft powder-like shavings.

A. *Chalcophora virginiensis*. Adult dull black, elytra, feebly bronzed. Abundant in June.

B. *Chalcophora liberta*. Adult brilliant coppery colored. Abundant in fall.



#### WHITE PINE INSECTS

A. Adult Roundheaded Borer. (Monochamus). (Natural size). B. Larva Roundheaded Borer. (Natural size). C. White Grub. (Natural size). D. Adult Flatheaded Borer. (Buprestid) (Natural size). E. Larva Flatheaded Borer. (Natural size). F. Adult White Pine Weevil. (Natural size). G. Adult Barkbeetle. (Greatly enlarged).

## Bark Beetles

Large numbers of bark beetles attack pine. For the most part they are secondary, attacking trees that have already been weakened or killed by other agencies. Bark beetles are small cylindrical insects usually under one-quarter of an inch in length. As the name suggests, they bore through the bark and tunnel just between it and the sapwood, scoring the wood in fantastic designs. The females lay their eggs in niches on the sides of the so-called egg tunnels and these hatch into minute white larvae which tunnel out from the adult or central gallery. The danger from bark beetles lies in the fact that they attack trees in great swarms and the combined efforts of these hosts girdle the trees just as surely as though they were hacked with an axe. Their presence first shows up as fine brown sawdust on the bark and in some cases, by pitch oozing out. Craighead has shown that they are particularly prevalent and dangerous during dry seasons when the lessened amount of sap in the trees gives them a better chance to mature. A large amount of literature has been written on bark beetles and the reader is referred to the works of such specialists as Swaine, Blackman, and Hopping for further facts.

A. *Ips pini*. This beetle at times becomes of primary importance, killing large trees particularly in the vicinity of lumbering operations. The adult beetle is about one-sixth of an inch long and attacks the trees during midsummer. The work of the insect is quite characteristic. From three to six egg tunnels radiate from a central chamber engraving the inner bark and deeply scoring the wood surface. The eggs are placed singly in niches along the sides. The larval mines are mainly on the surface of the inner bark, usually short and widening rapidly. Pupal cells are engraved in the wood.

B. *Dendroctonus valens*. This is the largest bark beetle attacking eastern species of pine, averaging about one-quarter of an inch in length, and is of a reddish-black color. The egg tunnels are usually found near the base of dead or dying trees. These tunnels are usually long horizontal ones slightly grooving the wood. The larvae feed in groups, excavating chambers.

C. *Pityogenes hopkinsi*. Minute black beetles in limbs of pine.



*D. Hylurgops pinifex*. Tunnels at base of trunk, often below surface of ground.

Control of bark beetle outbreaks depends largely upon cutting and salvaging infested timber. Logs from infested trees should either be put in water or the bark peeled off and exposed to the sun or burned. To quote from Hopping 'If a thorough campaign of slash disposal and control of incipient outbreaks is carried on in the future, the tremendous loss caused in the past to the forests—will not only be stopped, but much of the fire risk now caused by slash and dead standing timber will cease to exist.'

(Craighead, F. C., Journ. Ec. Ent., Vol. 18, No. 4, Pp. 577-586;—1925)  
(Hopping, R., Circ. 15, Dept. of Agr., Ottawa;—1921)

### **Ribbed Pine Borer**

*Rhagium lineatum*

This beetle commonly attacks pines the first two years after they have been killed and may be found anywhere from the base of the tree to the top. The adult is a grayish-black mottled beetle about one-half inch long with three elevated ribs on each wing cover. The adults feed on the pollen of flowers, particularly dogwood. The flat white grubs feed beneath the bark, pupating in the late fall. The life cycle takes two years.

(Hess, W. N., Mem. 33, Cornell Agr. Exp. Sta.;—1920)

### **Blue Pine Borer**

*Callidium antennatum*

A bluish flat beetle, one-half inch long, frequently issuing during June or July in great numbers from lumber in newly constructed houses. The larvae make broad wavy channels just under the bark, usually on wood that is quite dry. Rustic furniture is at times severely infested. Treating infested timbers with orthodichlorobenzine is recommended. All bark should also be peeled off.

### **Pine Cone Beetle**

*Conophthorus coniperda*

During the season 1925 a heavy infestation of this beetle occurred in pine stands in southern Maine, in places destroying practically the entire seed crop. The adult beetle is black, cylindrical, slightly less than one-eighth of an inch in length. The life history is somewhat in doubt, but the beetles apparently emerge in the spring and tunnel through the new

cones entering near the base, so weakening them that they fall to the ground. The tunnel of the beetle goes right through the center or axis of the cone, and eggs are laid along the sides in niches made by the beetle. The larvae, upon hatching, enter the seeds within the cone completely hollowing them out. At times this beetle also attacks the buds and twigs of white pine. Infested cones should be gathered and burned.

### Other Insect Enemies

*Neodiprion abietis*—Fir sawfly, attacks pitch pine. See insects attacking fir.

*Citheronia sepulchralis*—The pine devil. Larvae are defoliators.

*Coleophora laricella*—Larch case bearer. See insects attacking larch.

*Sapara bombycoides*—Harris pine hawk moth. Green caterpillar with yellow and white stripes, feed on pine in the fall.

*Decantha borkhausenii*—Lepidopterous bast miner, boring in bark. Exit holes appear like bark beetle work.

*Retinodiplosis resinicola*—Yellowish-orange maggots living in pitch masses on the branches.

*Camponotus herculeanus*

*pennsylvanicus*—Carpenter ants. See fir insects.

*Pytho americanus*—Adult is a black beetle with dark bluish-green striated wing covers. Larvae beneath bark.

*Gnathotrichus materiarius*—Pine wood stainer. This slender brownish-black beetle, about one-eighth of an inch long, tunnels through the wood leaving black stains.

*Asemum moestum*—Lesser pine borer. Dark brown beetle about one inch long on pine in fall of year. Larvae bore in trunks of pine.

*Pissodes approximatus*—A dark brown weevil the larvae of which occur in the thick bark of white, red, and pitch pine saplings, girdling the base of the trees.

*Pissodes affinis*—Weevil in thick bark on stumps of pine.

## INSECTS ATTACKING POPLAR

Three species of poplar are found growing native in Maine, and several exotic species are widely planted. Thousands of acres of burned land in northern Maine have seeded into poplar and this tree is of great economic importance to the pulpwood industry. At the present time there is evidence that poplar will be planted to a considerable extent as a quick growing pulpwood tree. The tree is attacked by a large number of insect pests and the future management of the poplar type must take into consideration insect prevention and control if satisfactory returns are to be obtained.

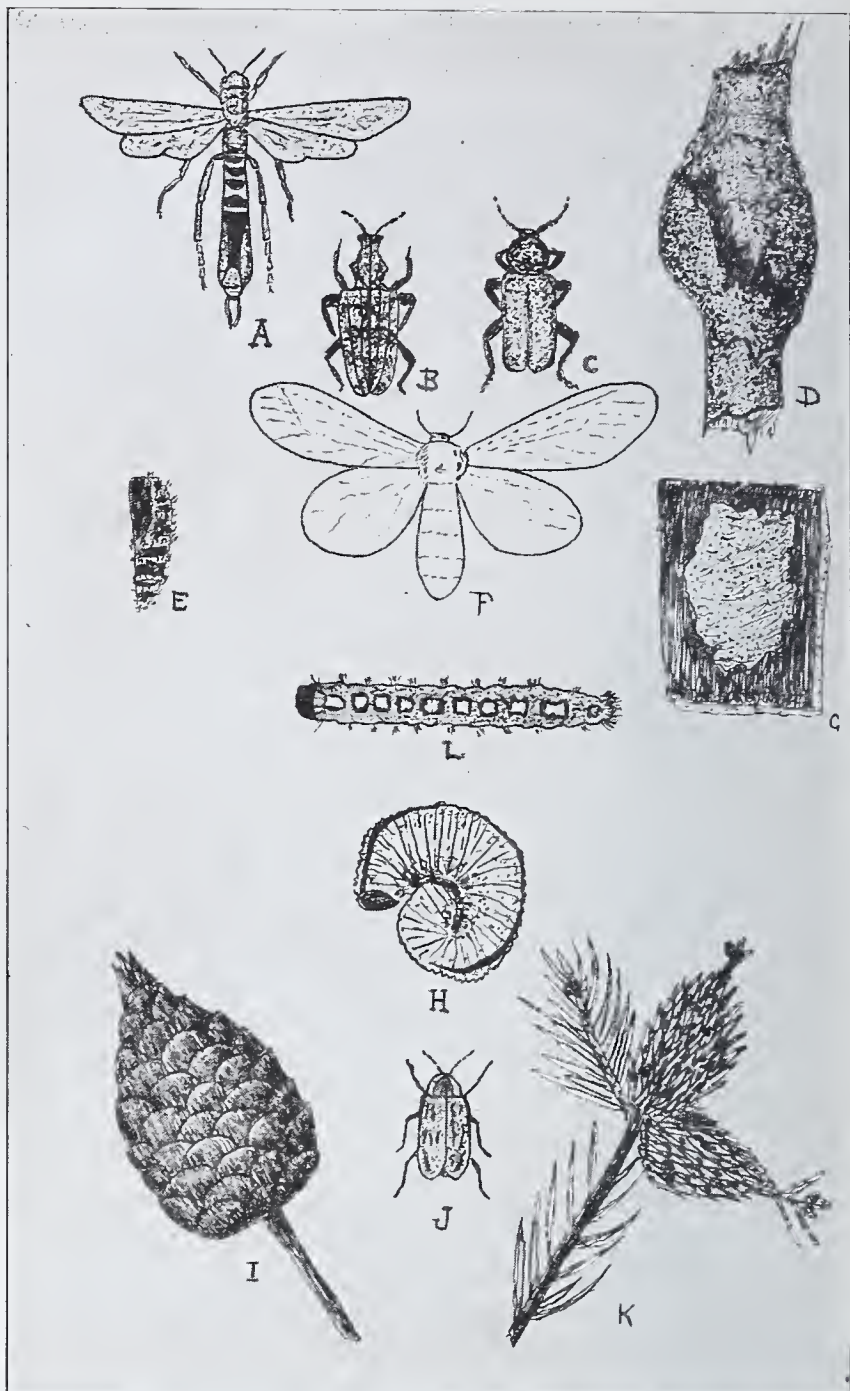
**Forest Tent Caterpillar***Malacosoma disstria*

This defoliating insect which is described under 'Insects Attacking Birch' very frequently strips large areas of poplar in northern Maine. It is still an open question as to how many complete strippings a poplar will stand without succumbing. There is no question, however, but that defoliation causes a slowing up of growth. Field work in 1923 showed very conclusively that outbreaks of the forest tent caterpillar do not necessarily spring up spontaneously over wide regions as is sometimes supposed, but that they may start in a small area within a large poplar stand and each year spread out further until the entire stand becomes infested. It is at this time that the insect attracts the greatest amount of attention and leads to the belief that the outbreak has been sporadic over the entire region. Such a condition will make feasible the possible future control of this insect by cutting or by dusting from an airplane.

**Satin Moth***Stilpnotia salicis*

In 1920 this European pest of poplar and willow was found to have gained a foothold near Boston, since which time it has rapidly spread into southern Maine. As the moths are good flyers and multiply rapidly, the insect is a real menace to poplar stands.

The moth is satiny-white in color with a wing expanse of about one and one-half inches. The body of the moth is actually black, but is covered with long white hairs giving it the satiny appearance. The eggs are laid the latter part of July in oval-shaped patches on the underside of leaves, on



A. Pigeon Tremex ( $\frac{1}{2}$  natural size). B. Adult Ribbed Pine Borer. C. Adult Blue Pine Borer. D. Work of Poplar Girdler ( $\frac{1}{2}$  natural size). E.F.G.L. Satin Moth—pupa—adult—egg mass—larva. H. Larva Elm Sawfly. I. Willow Cone Gall. J. Cottonwood Leaf Beetle. K. Work of Spruce Gall Louse ( $\frac{2}{3}$  natural size).



branches, trunks, grass, stonewalls, etc. An egg mass has an average of three hundred eggs covered with a silvery white secretion. Each female lays an average of five hundred and fifty eggs. Individuals have been known to lay over one thousand eggs. The eggs hatch in from two to three weeks.

The young larvae upon hatching feed on the epidermis of the leaves for about two weeks, molting twice. The winter is spent as third stage larvae within small webs or hibernaculums in crevices of the bark and are very inconspicuous, being about one-eighth of an inch long. The larvae again appear in May and feed until into July. When full grown they are from one to one and one-half inches long. The head is bluish-black covered with short hairs. The upper surface of the body is black with a series of large white spots along the back. There is a ring of brown tubercles between each segment. The pupal case is jet black partially covered with white or yellowish hairs and is enclosed in a loosely spun cocoon made in almost any convenient place. The moth emerges in about ten days.

Control consists of spraying the trees with arsenate of lead and painting the egg clusters with creosote.

(Burgess, A. F., U. S. D. A. Dept. Bul. 1469;—1927)

### **Cottonwood Leaf Beetle**

*Lina scripta*

Stands of poplar are at times completely defoliated by the cottonwood leaf beetle. The adults are somewhat flattened oval beetles about one-half inch long. The wing covers are yellowish, marked with three lines of interrupted black spots, which may vary greatly in shape and size. The beetles appear early in the spring and feed on the tender shoots, opening buds and leaves. The yellowish to red eggs are deposited in clusters on the under surface of the leaves. The eggs hatch in about two weeks. As the grubs mature they change from a dark brown color to a dirty yellow with brown head and black legs. The larval stage lasts about two weeks, during which time they feed on the foliage. The pupal case is attached to twigs or leaves. The adults pass the winter beneath the ground litter. They have the peculiar habit of expelling an ill smelling white fluid when disturbed.

Spraying of the trees with lead arsenate will control the insect. An especial effort should be made to spray both the under and upper sides of the leaves.

**Poplar Sawfly***Trichiocampus viminalis*

The larvae of the poplar sawfly have the habit of feeding side by side in parallel rows along the edges of the leaves particularly of Carolina poplar. The larvae are orange-yellow, spotted with black. When full grown the larva spins a cocoon between the leaves. The adult has a black head, the thorax is black above and yellow beneath, the abdomen is yellow. Eggs are laid in the leaf stalks and leaves. This insect is of European origin.

**Poplar Leaf Tyer***Melalopha inclusa*

This insect is frequently called the poplar tent maker. The larvae are leaf feeders, eating first the underside of the leaves, later devouring the entire leaf. In color, they are black, irregularly mottled with grayish-white, with yellow stripes on the sides. Feeding takes place during June and July, and apparently in some sections a second generation occurs during August and September. When not feeding the larvae spend the time within a shelter made by tying leaves together with silk. The moths are pale gray with a wing expanse of about one inch. This insect is reported from several sections in eastern United States.

(Houser, J. S., Bul. 332, Ohio Agr. Exp. Station, Pp. 256-7;—1918)

**Poplar Borer***Saperda calcarata*

The poplar borer is of considerable economic importance and destroys large numbers of trees. Apparently trees growing in the open are the most seriously attacked, so that the opening up of a stand is often followed by the death of the remaining trees. The injury shows up as dying tops, and blackened swollen scars on the surface of the trunk or limbs. In the spring large amounts of borings usually show up on the trunk or around the base of the trees.

The adult is a handsome, long horned beetle, slightly over an inch in length, gray in color, mottled with patches of yellow. Eggs are laid during July and August in slits cut in the bark. The first year the larvae feed in the inner bark and outer sapwood. The second year they bore deep into the wood. Pupation takes place near the center of smaller limbs deep in the

wood. It is believed that the poplar borer requires three years to complete its life cycle.

Infested trees should be cut and burned. In the case of ornamental trees, the egg scars should be painted with creosote. (Felt, E. P., N. Y. State Mus. Bul. 74, Pp. 39-44;—1904)

### Poplar Girdler

*Saperda concolor*

The larvae of this insect girdle the trunks of young poplars causing a gall from one and one-half to two inches in diameter. When about ready to pupate the larvae form a short straight gallery up into the wood parallel to the stem. The trees frequently break off at this point or are severely weakened and disfigured. Rots and insects frequently enter through the wound. The adults appear the following June and after mating the female gnaws a slit in the bark depositing a single egg in each end of the slit. A gnarly warty swelling forms around each incision. The adult is a black beetle with numerous small punctures and covered with a dense yellowish-gray pubescence. The adult averages about one-half inch in length. The long antennae are marked alternately with black and gray.

Observations in the field have shown that the greatest damage occurs in dense slow-growing stands. Judicial thinning in which the infested trees are cut and burned should do much, not only to stamp an infestation out, but to increase the growth of the other trees so that they will be better able to overcome subsequent injury.

### Other Insect Enemies

*Paleacrita vernata*—Spring canker worm. See insects attacking elm.

*Alsophila pometaria*—Fall canker worm. See insects attacking ash.

*Halisidota maculata*—Spotted tussock moth. Larvae covered with tufts of jet black and yellow hairs.

*Erannis tiliaria*—Lime tree span worm. See insects attacking basswood.

*Catocala concumbens*—Larvae are defoliators.

*Catocala cara*—Larvae have purplish heads, bodies light gray to gray-brown. Smoky band on each side. Reddish beneath.

*Hemerocampa leucostigma*—White marked tussock moth. See insects attacking elm.

*Hyphantria cunea*—Fall web worm. See insects attacking ash.

*Lithocolletis salicifoliella*—Mines on underside of leaves.

*Lithocolletis populiella*—Broad mine with frass in center.

*Pemphigus betae*—Beet aphid. Causes folded leaves.

*Lepidosaphes ulmi*—Oyster shell scale. See insects attacking ash.

*Pemphigus populitransversus*—Poplar leaf stem gall.

*Agromyza schineri*—Spongy gall on sides of twigs.

*Saperda vestita*—Linden borer. See insects attacking basswood.

*Buprestis fasciata*—Banded buprestid. Brilliant green flat beetle with yellow markings. Wood borer.

*Trypodendron retusum*—Ambrosia beetle in dying poplars.

*Anisandrus populi*—Bark beetle in dying poplars.

## INSECTS ATTACKING SPRUCE

Three species of spruce occur in Maine—the red, black, and white. Of these the red spruce is the most common and makes up a high percentage of the forest in the northern two-thirds of the State. Spruce leads all other trees in amount of annual cut, being not only the principal source of pulpwood, but also practically equalling white pine in amount of lumber cut. Spruce has two very serious insect enemies that deserve the most serious consideration when methods of planting, management, and protection are being considered. The spruce bud worm and spruce bark beetle have repeatedly killed billions of feet of spruce in Maine.

### Spruce Budworm

*Cacoecia fumiferana*

The life history and habits of the spruce budworm have previously been discussed under 'Insects Attacking Fir' as



this tree is its favorite host. From a monetary standpoint the loss of spruce is possibly greater than the loss of fir from budworm infestations.

White spruce, except when growing under adverse conditions, is rarely killed by the budworm. This seems to be due to the fact that the needles develop rapidly and harden before the larvae have a chance to mature.

Much of the damage to black spruce comes from the fact that the buds of this tree are late in opening so that the larvae feeding on the unopened buds destroy the growth before it has a chance to start.

The growth of red spruce is particularly favorable to the budworm so that the greatest damage occurs to this tree.

It is the general opinion of forest entomologists who have made a study of the spruce budworm that new outbreaks are likely to occur at any time that large amounts of green fir become dominant in the forest. Such areas occur in many localities in the East and particularly in Maine, and should be carefully watched.

### **Spruce Sawfly**

*Pteronus integer*

During the latter part of the summer uniformly pale green sawfly larvae may be found feeding singly on spruce foliage. The adult, which appears early in June, is dull amber-yellow, marked with black.

### **Spruce Gall Aphid**

*Adelges abietis*

The spruce gall aphid produces pineapple-shaped green galls at the base of young spruce shoots in the early summer. The twigs beyond the galls frequently die so that individual trees and at times fairly large areas may be almost entirely defoliated. Such a condition exists on some of the spruce covered islands off from the coast of Maine. The winter is spent as young aphids or nymphs in crevices of stems or at the base of the buds. At this time they appear like small grains of gun powder. In the spring, as they mature, they secrete white waxy hairs. Clusters of from one hundred and fifty to two hundred yellow eggs are laid at the base of the buds. The eggs hatch in about a week, and the young crawl to the newly opening tender shoots and establish themselves in

cracks at the base of the leaves. As the buds develop the young aphids become enclosed in a series of chambers where they feed. Later in the season the galls turn brown and crack open and the winged aphids escape. These mature aphids lay from forty to fifty eggs each on the leaves, and in about a week the young nymphs appear and seek shelter for the winter.

On hedges and individual ornamental trees green galls should be picked off and burned. Spraying of trees with 'Scalecide' at the rate of one quart to twenty quarts of water, or with dry lime sulphur at the rate of sixteen and one-half pounds to fifty gallons of water, in the early spring before the buds open is recommended. This spray destroys the young nymphs before the galls are formed.

(Herrick, G. W. & Tanaka, Jr., Cornell Agri. Exp. Sta., Bul. 454;—1926)

### **Spruce Cone Worm**

*Dioryctria reniculella*

Young spruce cones are at times webbed together with masses of excreta forming unsightly masses. The insect causing the injury is a red-headed brownish caterpillar which tunnels through the cones, separating the scales from the axis and at times feeding also on the foliage. The larvae may mine from one cone into another. When full grown they are slightly over one-half inch in length. The moths which appear in August are stone-gray in color with long narrow wings.

### **Spruce Bud Scale**

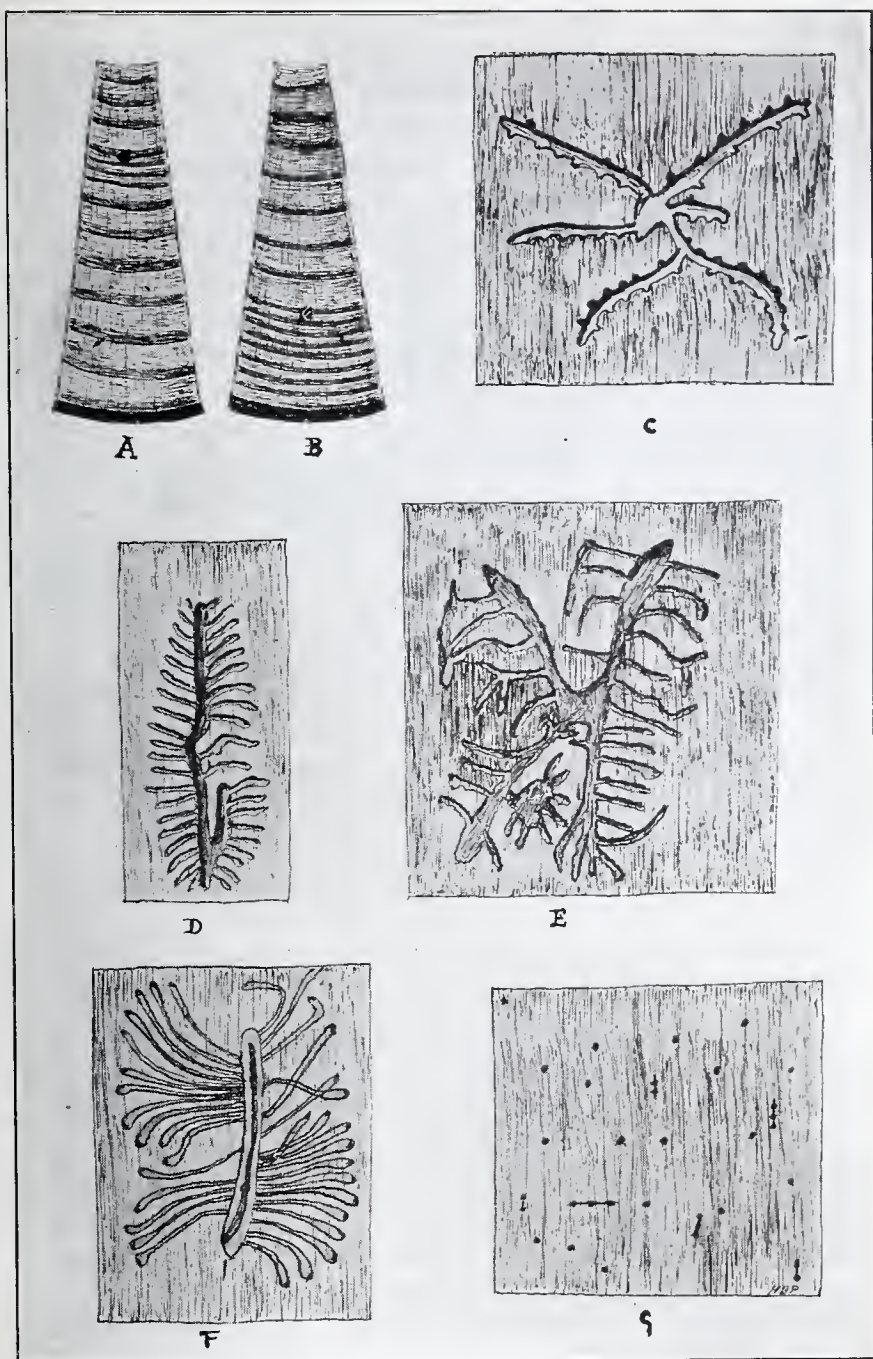
*Physokermes piceae*

Clusters of from two to six chestnut-brown sub-globular scales, one-eighth of an inch in diameter, having the appearance of abnormal buds, may be found in the axils of weakened or dying twigs. A secretion given off by the scales often attracts swarms of bees. The young crawl late in July, and trees should be sprayed with nicotine sulphate at this time.

### **Spruce Bark Beetle**

*Dendroctonus piceaperda*

This insect often known as the spruce-destroying bark beetle has been responsible for the death of large quantities of spruce and has in the past followed in the wake of budworm outbreaks, killing trees that were left in a weakened condition. The injury shows up first as pitch tubes and reddish borings on the



# WORK OF SPRUCE, FIR, AND PINE INSECTS.

- A. Cross section of spruce showing ring retardation, due to defoliation, on tree that has recovered from Budworm. B. Ring retardation on tree that has not recovered. C. Egg tunnels of *Pityokteines sparsus* in fir. (Slightly enlarged). D. Tunnels of *Ips perturbatus* in white spruce. ( $\frac{1}{4}$  natural size). E. Tunnels of *Ips pini* in white pine. ( $\frac{1}{2}$  natural size). F. Egg tunnel and larval mines of *Dendroctonus piccaperda* in spruce. G. Tunnels of Ambrosia Beetles in wood of spruce.



trunk of the large trees, for the beetle rarely attacks trees under ten inches in diameter. The adult beetles appear about three weeks after the balsam buds open, and are the largest found in spruce, averaging one-quarter of an inch in length. The beetles are very robust, the wing covers are brown to black in color and the head, thorax and abdomen are black. The egg tunnels made by the beetles beneath the bark are from four to ten inches long, usually running with the grain of the wood. Eggs are laid in alternate layers along the sides of the tunnels. The larvae bore in the inner bark at right angles to the egg tunnel and pupate in small oval cells between the bark and wood. The larvae are curved, yellowish-white, legless, grubs and mature in about two months. The death of spruce trees comes from the attacks of vast hosts of the beetles girdling the trees and thus shutting off the flow of sap. The needles on dying or dead spruce usually begin falling while green.

Infested trees should be logged between October and May while the beetles are still in the trees and the logs put in water, or peeled, before the first of June. Logging operations in the future must take into consideration insect outbreaks or the eastern forest will suffer further tremendous losses.

(Hopkins, A. D., U. S. D. A. Bur. of Ent., Bul. 83, Part 1;—1909)

## Spruce Ambrosia Beetle

*Trypodendron bivittatum*

Ambrosia beetles attack dying or dead spruce about a week before the balsam buds open. The small black cylindrical beetles, about one-eighth inch in length, with two longitudinal stripes of yellowish-brown in the wing covers, bore directly through the bark into the sapwood, making a hole about the size of the lead in a lead pencil. About an inch within the wood the tunnel forms into two widely divergent branches, along the sides of which shallow niches are formed in which the eggs are laid. The larvae work out a short distance from the egg tunnel. The walls of the tunnel soon become covered with a fungus growth, known as ambrosia, on which both the adults and larvæ feed. This fungus later stains the walls of the tunnels dark brown to black. Adults appear for a second generation in about two months.

(Craighead, F. C., Can. Dept. of Agri., Bul. No. 37, n. s., P. 22;—1924)



**Four-eyed Spruce Bark Beetle** *Polygraphus rufipennis*

This small, black, stout beetle, about one-tenth inch long, with the eyes divided into upper and lower lobes, forms radially branched tunnels from one to two inches long in the inner bark, slightly scoring the wood. The beetles are particularly abundant in dead spruce.

**Canadian Spruce Bark Beetle** *Ips perturbatus*

A small stout brown to black bark beetle slightly over one-eighth of an inch in length tunnels chiefly in white spruce, between the bark and wood of the middle trunk. The beetles are characterized by having the posterior face of the wing covers excavated, and armed with four distinct teeth. The beetles form a central chamber from which two or three egg tunnels extend either upward or downward.

**Red Turpentine Beetle** *Dendroctonus valens*

A stout, light to dark red, cylindrical bark beetle, one-quarter of an inch in length attacks the living bark on injured trees near the base, forming irregular longitudinal egg galleries.

**Blazed Tree Borer** *Serropalpus barbatus*

The larvae of this beetle very commonly enter wounds caused by the blazing of trees, boring deeply into both sapwood and heartwood. The larvae are slender and white.

**Other Insect Enemies**

*Recurvaria piceaella*—Minute gray moths in June. Pale brown larvae with dark green patch on each abdominal segment, mine and web needles until late fall.

*Epinotia piceafoliana*—Needles of Norway and black spruce mined by greenish larvae with black heads and thoracic legs. Cocoon spun between needles close to twig. Moths appear in June.

- Epinotia nanana*—Larvae webbing terminal spruce needles.
- Tortrix alleniana*—Moths light yellow-brown. Larvae defoliators.
- Hemerocampa leucostigma*—Defoliator. See insects attacking elm.
- Basilona imperialis*—Large horned dark green to brown caterpillar.
- Neodiprion abietis*—See insects attacking fir.
- Lachnus abietis*—Black aphid on spruce.
- Gilletea cooleyi*—Blue spruce gall aphid.
- Chionaspis pinifoliae*—Pine leaf scale. See insects attacking pine.
- Lachnosterna Spp.*—White grubs. See insects attacking pine.
- Pissodes strobi*—White pine weevil. White spruce apparently immune. See insects attacking pine.
- Parharmonia pini*—Pitch mass borer. See insects attacking pine.
- Monochamus scutellatus*—Round-headed borer. See insects attacking pine.
- Monochamus notatus*—Round-headed borer. See insects attacking pine.
- Buprestis maculiventris*—Flat-headed borer. Adults in June and July.
- Chrysobothris femorata*—Flat-headed borer. Metallic grayish flat beetle.
- Callidium antennatum*—Blue pine borer. See insects attacking pine.
- Merium proteus*—Larvae beneath bark. Cause much damage to rustic work.
- Asemum moestum*—Larvae bore in sapwood.
- Camponotus herculeanus*—Carpenter ants. See insects attacking fir.
- Urocerus abdominalis*—Banded horntail. Large black wasp-like fly. Larvae wood borers.
- Paururus cyaneus*—Blue horntail. Small wasp-like fly. Blue abdomen. Reddish legs. Larvae wood borers.

## INSECTS ATTACKING WILLOW

The willow is very common in Maine, particularly along streams, but is not of great economic value as far as the value of the wood goes. The insects attacking willow are almost identical with those attacking poplar, as the two genera of trees are closely related.

**Willow Cone Gall***Rhabdophaga strobiloides*

Cone-like galls about one inch long on the tips of willow shoots in June are formed by small midges which appear in April and May.

**Spotted Willow Leaf Beetle***Lina lapponica*

During midsummer the foliage is sometimes attacked by small black-spotted reddish beetles, about one-quarter of an inch long.

**Yellow-spotted Willow Slug***Pteronus ventralis*

Black slug-like grubs feeding on foliage. Eggs laid on upper side of leaves causes them to swell.

**Willow Leaf Beetle***Gallerucella decora*

A dull yellow to dusky brown beetle approximately one-fifth of an inch long at times becomes a serious defoliator.

**Imported Willow Leaf Beetle***Plagiodera versicolora*

Although this insect has gained a foothold in the East it has not as yet been reported from Maine. The small metallic blue beetles about one-eighth of an inch long appear in May and a second generation appears in July. The grubs are dark in color.

**Willow Snout Beetle***Orchestas rufipes*

A recent outbreak of this insect occurred in southern Maine on the laurel-leaved willow. The minute black snout beetles feed on the foliage and the larvae mine within the leaves.

**Poplar and Willow Borer***Cryptorhynchus lapathi*

Young trees are at times completely riddled by the small white legless larvae of the poplar and willow borer. The adult beetles appear in midsummer. These are a rather large snouted weevil about one-third of an inch in length. The general color is a dark gray with the posterior third of the wing covers light gray to white. The females lay their small white eggs in the bark. These hatch in about three weeks and the larvae honeycomb the wood pupating the following June. Infested trees should be cut and burned.

**Willow Gall Borer***Saperda moesta*

A dark gray, long-horned beetle with black pubescence, about three-eighths of an inch in length, attacks both the Balm of Gilead and the willow, causing galls on the smaller branches usually near the base of the buds. The bark on the gall-like swellings often decays.

(Felt, E. P., N. Y. State Mus., Bul. 74, Pp. 71-73;—1904)

**Other Insect Enemies**

*Stilpnotia salicis*—Satin moth. See insects attacking poplar.

*Malacosoma disstria*—Forest tent caterpillar. See insects attacking birch.

*Euproctis chrysorrhoea*—Brown tail moth. See insects attacking oak.

*Porthetria dispar*—Gipsy moth. See insects attacking oak.

*Hyphantria cunea*—Fall web worm. See insects attacking ash.

*Tropea luna*—Luna moth. See insects attacking birch.

*Samia cecropia*—Cecropia moth. See insects attacking cherry.

*Telia polyphemus*—Polyphemus moth. See insects attacking birch.

*Halisidota maculata*—Oak tussock caterpillar.

*Cimbex americana*—Elm and willow sawfly. See insects attacking elm.

*Catalpa lanigera*—Goldsmith beetle. Entirely golden-yellow, defoliator.



*Lepidosaphes ulmi*—Oyster shell scale. See insects attacking ash.

*Lina scripta*—Cottonwood leaf beetle. See insects attacking poplar.

*Saperda calcarata*—Poplar borer. See insects attacking poplar.

*Saperda concolor*—Poplar girdler. See insects attacking poplar.

## PRINCIPAL FOREST TREES OF MAINE COVERED BY THIS BULLETIN

### Alder

Speckled

*Alnus incana*

### Arbor vitae

White cedar

*Thuja occidentalis*

### Ash

Black

*Fraxinus nigra*

Red

*Fraxinus pennsylvanica*

White

*Fraxinus americana*

### Basswood

Linden

*Tilia americana*

### Beech

*Fagus grandifolia*

### Birch

Black

*Betula lenta*

Gray

*Betula populifolia*

White

*Betula papyrifera*

Yellow

*Betula lutea*

### Butternut

*Juglans cinerea*

### Cedar

See Arbor Vitae

### Cherry

Black

*Prunus serotina*

Choke

*Prunus virginiana*

Red

*Prunus pennsylvanica*

### Chestnut

*Castanea dentata*

### Elm

American

*Ulmus americana*

### Fir

Balsam

*Abies balsamea*

### Hemlock

*Tsuga canadensis*

**Hickory**

Bitternut

*Hicoria cordiformis*

Pignut

*Hicoria glabra*

Shagbark

*Hicoria ovata***Larch**

Tamarack or Hackmatack

*Larix laricina***Locust**

Black

*Robinia pseudacacia*

Honey

*Gleditsia triacanthos***Maple**

Ash-leaved

*Acer negundo*

Mountain

*Acer spicatum*

Red

*Acer rubrum*

Silver

*Acer saccharinum*

Striped

*Acer pennsylvanicum*

Sugar

*Acer saccharum***Oak**

Black

*Quercus velutina*

Burr

*Quercus macrocarpa*

Red

*Quercus rubra*

Scarlet

*Quercus coccinea*

Swamp

*Quercus bicolor*

White

*Quercus alba***Pine**

Jack

*Pinus banksiana*

Pitch

*Pinus rigida*

Red

*Pinus resinosa*

White

*Pinus strobus***Poplar**

Aspen

*Populus tremuloides*

Balsam

*Populus balsamifera*

Large-toothed aspen

*Populus grandidentata***Spruce**

Black

*Picea mariana*

Red

*Picea rubra*

White

*Picea glauca***Willow**

Black

*Salix nigra*

## INDEX

## A.

- Abbott's pine sawfly—96
- Airplane, dusting from—18
- Alder, Insects attacking—22
  - Alder blight aphid—22
  - Alder flea beetle—23
  - Alder gall borer—24
  - Alder leaf roller—24
  - Alder weevil—24
  - Other insect enemies—25
- American tent caterpillar—48
- Animals, injury from—12
- Antlered maple caterpillar—83
- Arbor vitae, Insects attacking—25
  - Bag worm—26
  - Leaf miner—25
  - Other insect enemies—26
- Ash, Insects attacking—27
  - Ash flower gall—31
  - Banded ash borer—30
  - Fall canker worm—27
  - Fall web worm—27
  - Four-marked ash borer—30
  - Oyster shell scale—28
  - Round-headed borer—30
  - Other insect enemies—31

## B.

- Bacteria—9
- Bag worm—26
- Balsam bark beetle—67
- Balsam bark weevil—66
- Balsam gall midge—65
- Balsam sawyer—66
- Banded ash borer—30
- Banded purple—40
- Bark beetles (pine)—108
- Basswood, Insects attacking—32
  - Broad-necked prionus—35
  - Leaf mining linden beetle—34
  - Leaf roller—32
  - Lime tree winter moth—32
  - Linden borer—34
  - Linden leaf beetle—33
  - Twig girdler—35
  - Walking stick—33
  - Other insect enemies—35
- Beautiful hickory borer—72
- Beech, Insects attacking—36
  - Beech span worm—36
  - Beech tree blight aphid—37
  - Divaricated buprestis—37
  - Felted beech scale—36
  - New York weevil—38
  - Woolly beech leaf aphid—37
  - Other insect enemies—38

- Birch, Insects attacking—38
  - Banded purple—40
  - Birch horntail—44
  - Birch leaf skeletonizer—40
  - Bronze birch borer—43
  - Catocala—42
  - Forest tent caterpillar—39
  - Leaf miner—43
  - Luna moth—40
  - Notched winged geometrid—42
  - Pith ray miners—44
  - Polyphemus—42
  - Other insect enemies—44
- Birds, insectivorous—18
- Blazed tree borer—121
- Blue pine borer—109
- Broad-necked prionus—35
- Bronze birch borer—43
- Brown tail moth—91
- Butternut, Insects attacking—45
  - Butternut wooly worm—45
  - Catocala—46
  - Hickory horned devil—46
  - Virginia tiger moth—46
  - Walnut curculio—47
  - Wood borers—47
  - Other insect enemies—48

## C.

- Canadian lepta—70
- Canadian spruce bark beetle—121
- Carpenter worm—87
- Catocala (birch)—42
- Catocala (butternut)—46
- Cecropia—50
- Cedar (see arbor vitae)—48
- Cherry, Insects attacking—48
  - American tent caterpillar—48
  - Cecropia moth—50
  - Cherry leaf beetle—49
  - Cherry worm—49
  - Clear wing moth—51
  - Common flat-headed borer—50
  - Io caterpillar—50
  - Oblique banded leaf roller—49
  - Plum curculio—51
  - Round-headed apple tree borer—50
  - Round-headed borer—51
  - Other insect enemies—51
- Chemicals, Injuries to trees from—12
- Chestnut, Insects attacking—52
  - Chestnut timber worm—52
  - Chestnut weevils—53
  - Two-lined chestnut borer—52
  - Other insect enemies—53
- Clear wing moth—51

Common flat-headed borer—50  
 Cottonwood leaf beetle—113  
 Cottony maple scale—85

## D.

Diseases of insects—20  
 Divaricated buprestis—37  
 Dog-day cicada—84  
 Drying out, trees killed by—11  
 Dust, trees killed by—11

## E.

Eastern larch beetle—79  
 Elm, Insects attacking—53  
   Elm bark beetle—58  
   Elm bark louse—57  
   Elm borer—58  
   Elm leaf beetle—54  
   Elm sawfly—57  
   Elm snout beetle—58  
   European elm case bearer—55  
   Spiny elm caterpillar—56  
   Spring canker worm—56  
   White marked tussock moth—55  
   Wooly elm bark aphid—57  
   Other insect enemies—58  
 European elm case bearer—55  
 European pine shoot moth—100  
 Evergreen span-worm—69

## F.

Fall canker worm—27  
 Fall webworm—27  
 False pine webworm—100  
 Felted beech scale—36  
 Fir, Insects attacking—59  
   Balsam bark beetle—67  
   Balsam bark weevil—66  
   Balsam gall midge—65  
   Balsam sawyer—66  
   Black carpenter ant—67  
   Fir needle inch worm—65  
   Fir sawfly—64  
   Red-head inch worm—65  
   Spruce budworm—60  
   Other insect enemies—68  
 Flat-headed borers (pine)—106  
 Flat-headed hemlock borer—69  
 Forest tent caterpillar—39  
 Forest tent caterpillar (poplar)—111  
 Four-eyed spruce beetle—121  
 Four-marked ash borer—30  
 Fungi—9

## G.

Galls on maple—86  
 Galls on oak—92  
 Gipsy moth—89  
 Gipsy moth (on pine)—98  
 Green maple worm—83  
 Green-striped maple worm—82

## H.

Hemlock, Insects attacking—68  
   Canadian leptura—70  
   Evergreen span-worm—69  
   Flat-headed hemlock borer—69  
   Hemlock scale—69  
   Hemlock span-worm—69  
   Lesser prionus—70  
   Round-headed hemlock borer—70  
   Other insect enemies—70  
 Hickory horned devil—46  
 Hickory, Insects attacking—71  
   Beautiful hickory borer—72  
   Hickory bark beetle—71  
   Hickory saperda—72  
   Hickory timber beetle—72  
   Hickory tussock moth—71  
   Red-edged saperda—72  
   Other insect enemies—73

## I.

Imported pine sawfly—95  
 Imported willow leaf beetle—123  
 Insects, Injury from—13  
 Io caterpillar—50

## L.

Larch, Insects attacking—73  
   Eastern larch beetle—79  
   Larch case bearer—76  
   Larch lappet moth—78  
   Larch sawfly—74  
   Larch tip moth—78  
   Wooly larch aphid—78  
   Other insect enemies—79  
 Leaf miner (arbor vitae)—25  
 Leaf miner (birch)—43  
 Leaf mining linden beetle—34  
 Leaf roller—32  
 Leconte's sawfly—96  
 Leopard moth—92  
 Lesser oak carpenter worm—94  
 Lesser prionus—70  
 Lime tree winter moth—32  
 Linden (see basswood)—32  
 Linden borer—34  
 Linden leaf beetle—33



Locust, Insects attacking—80  
 Locust borer—81  
 Locust leaf beetle—80  
 Locust twig borer—81  
 Red-footed flea beetle—81  
 Other insect enemies—82  
 Luna Moth—40

### M.

Maples, Insects attacking—82  
 Antlered maple caterpillar—83  
 Carpenter worm—87  
 Cottony maple scale—85  
 Dog-day cicada—84  
 Galls—86  
 Green maple worm—83  
 Green striped maple worm—82  
 Maple leaf cutter—84  
 Maple sesian—88  
 Norway maple aphid—85  
 Pigeon tremex—87  
 Sugar maple borer—86  
 Other insect enemies—88  
 Maple and oak twig pruner—93  
 Mistletoe—10  
 Mites—12  
 Mound building ants—97

### N.

New York weevil—38  
 Norway maple aphid—85  
 Notched winged geometrid—42

### O.

Oak, Insects attacking—89  
 Brown tail moth—91  
 Gipsy moth—89  
 Leopard moth—92  
 Lesser oak carpenter worm—94  
 Maple and Oak twig pruner—93  
 Oak galls—92  
 Pale tussock moth—92  
 Twig girdler—93  
 Other insect enemies—94  
 Oblique-banded leaf roller—49  
 Oyster shell scale—28

### P.

Pales weevil—104  
 Pale tussock moth—92  
 Parasites—19

Pine, Insects attacking—95  
 Abbott's pine sawfly—96  
 Bark beetles—108  
 Blue pine borer—109  
 European pine shoot moth—100  
 False pine webworm—100  
 Flat-headed borers—106  
 Gipsy moth—98  
 Imported pine sawfly—95  
 Leconte's sawfly—96  
 Mound building ants—97  
 Pales weevil—104  
 Pine bark aphid—99  
 Pine cone worm—109  
 Pine leaf miner—99  
 Pine leaf scale—99  
 Pine moth—100  
 Pine sheath miner—101  
 Pine spittle bug—101  
 Pine tube builder—96  
 Pine webworm—100  
 Pitch mass borer—101  
 Pitch twig moth—100  
 Ribbed pine borer—109  
 Round-headed borers—105  
 Strawberry crown girdler—101  
 White grubs—101  
 White pine aphid—98  
 White pine weevil—103  
 Other insect enemies—110

Pigeon tremex—87  
 Pitch mass borer—101  
 Pitch twig moth—100  
 Pith ray miner—44  
 Plum curculio—51  
 Polyphemus—42  
 Poplar, Insects attacking—111  
 Cottonwood leaf beetle—113  
 Forest tent caterpillar—111  
 Poplar borer—114  
 Poplar girdler—115  
 Poplar leaf tyer—114  
 Poplar sawfly—114  
 Satin moth—111  
 Other insect enemies—115  
 Poplar and willow borer—124

### R.

Red-edged saperda—72  
 Red-footed flea beetle—81  
 Red head inch worm—65  
 Red turpentine beetle—121  
 Ribbed pine borer—109  
 Root competition—11  
 Roots, smothering of—12  
 Round-headed apple tree borer—50  
 Round-headed borer (ash)—30  
 Round-headed borer (cherry)—51  
 Round-headed borer (pine)—105  
 Round-headed hemlock borer—70

## S.

Satin moth—111  
 Spiny elm caterpillar—56  
 Spotted willow leaf beetle—123  
 Spring canker worm—56  
 Spruce, Insects attacking—116  
   Blazed tree borer—121  
   Canadian spruce bark beetle 121  
   Four eyed spruce bark beetle 121  
   Red turpentine beetle—121  
   Spruce ambrosia beetle—120  
   Spruce bark beetle—118  
   Spruce bud scale—118  
   Spruce budworm—116  
   Spruce cone worm—118  
   Spruce gall aphid—117  
   Spruce sawfly—117  
   Other insect enemies—121  
 Spruce budworm—60  
 Strawberry crown girdler—101  
 Sugar maple borer—86  
 Sunlight, lack of—11  
 Sun scald—10

## T.

Tree, growth of—7  
 Twig girdler (basswood)—35  
 Twig girdler (oak)—93  
 Two-lined chestnut borer—52

## V.

Virginia tiger moth—46

## W.

Walking stick—33  
 Walnut curculio—47  
 Water level, change of—11  
 White grubs—101  
 White-marked tussock moth—55  
 White pine aphid—98  
 White pine weevil—103  
 Willow, Insects attacking—123  
   Imported willow leaf beetle—123  
   Poplar and willow borer—124  
   Spotted willow leaf beetle—123  
   Willow cone gall—123  
   Willow gall borer—124  
   Willow leaf beetle—123  
   Willow snout beetle—123  
   Yellow-spotted willow slug—123  
   Other insect enemies—124  
 Winter injury—10  
 Witches broom—9  
 Wood borers—(butternut)—47  
 Wooly beech leaf aphid—37  
 Wooly elm bark louse—57  
 Wooly larch aphid—78

## Y.

Yellow spotted willow slug—123



